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AD-A039 100

DDC/BIB-77/04

SOLAR CELLS AND SOLAR PANELS

A DDC BIBLIOGRAPHY

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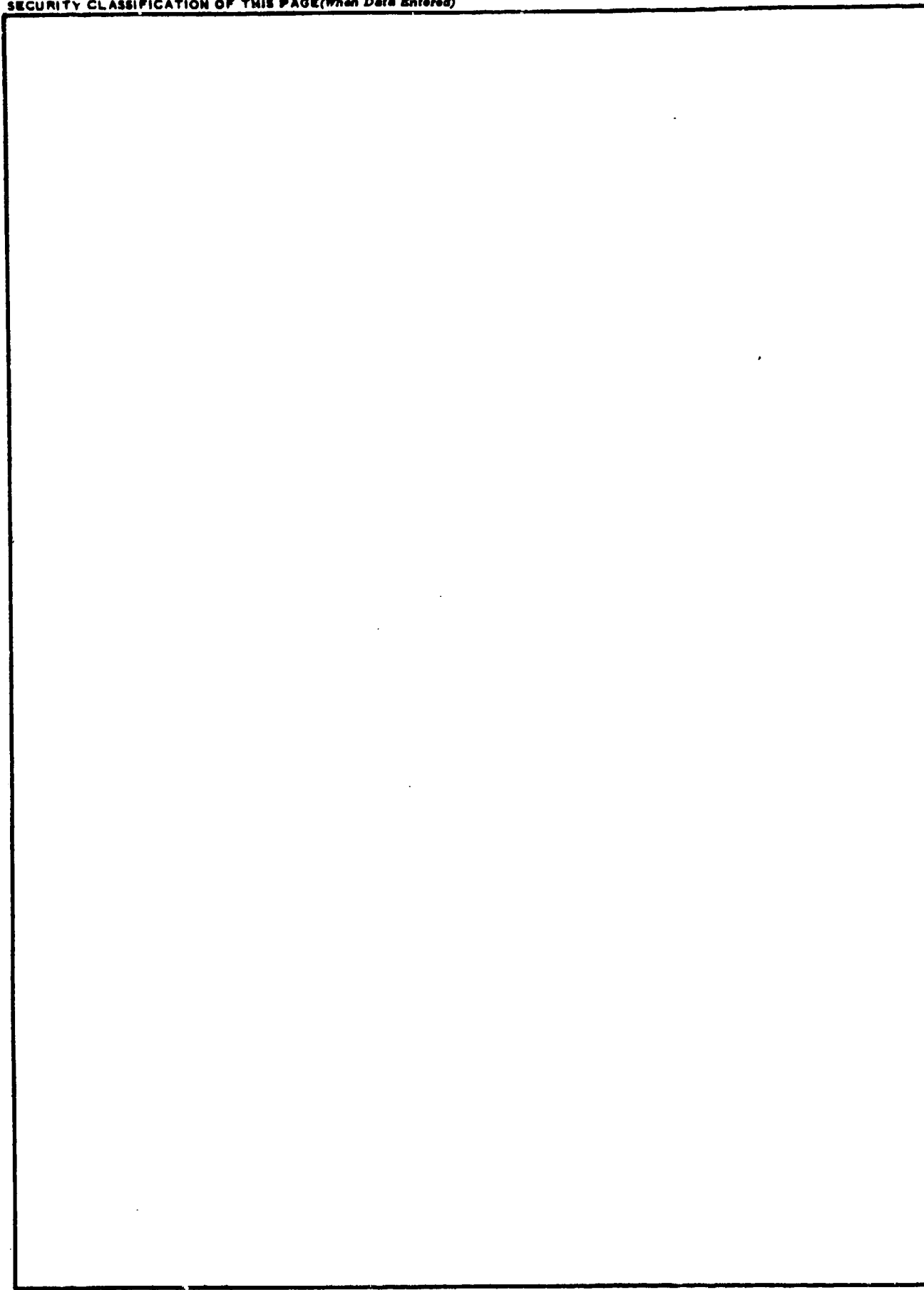
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FOREWORD

This unclassified and unlimited bibliography contains 213 selected citations of reports on *Solar Cells and Solar Panels*. These references were selected from entries processed into the Defense Documentation Center's AD data bank during the period of January 1953 through December 1976.

This bibliography supersedes *Solar Cells and Solar Panels*, AD-768 400, DDC-TAS-73-51, dated October 1973.

Entries are sequenced by AD number. Computer-generated indexes of Corporate Author-Monitoring Agency, Subject, Title and Personal Author are provided.

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Defense Documentation Center

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 257 494

TRANS WORLD AIRLINES INC KANSAS CITY MO

HIGH EFFICIENCY SILICON SOLAR CELLS

(U)

DEC 60 IV LAMOND, PIERRE; BERMAN, PAUL;
CONTRACT: DA36 039SC85250
MONITOR: ARPA 80 59

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER SUPPLIES, *SOLAR CELLS, CALIBRATION,
COATINGS, CRYSTALS, DESIGN, DIFFUSION, EFFECTIVENESS,
ELECTRON IRRADIATION, MATERIALS, PHOTSENSITIVITY,
DAMAGE, RADIATION EFFECTS, REFLECTION, SEMICONDUCTORS,
SILICON, TESTS (U)

A SUMMARY IS PRESENTED OF THE PROCESS USED AT TRANSITRON FOR THE P ON N SOLAR CELLS. THESE HAVE BEEN SUPERSEDED BY THE MORE RADIATION RESISTANT N ON P TYPE CELLS. PROBLEMS IN OPTIMIZING THE JUNCTION DEPTH OF SOLAR CELLS ARE DISCUSSED. THE RESULTS OF DIFFUSION EXPERIMENTS ARE PRESENTED. THE CALIBRATION OF SOLAR CELL STANDARDS AND ARTIFICIAL LIGHT SYSTEMS FOR THE TESTING OF SOLAR CELLS IS DISCUSSED. SPECIAL ATTENTION IS GIVEN TO THE PROBLEMS ENCOUNTERED IN USING A TUNGSTEN ARTIFICIAL LIGHT SOURCE TO DETERMINE THE EFFICIENCY OF SOLAR CELLS. EXPERIMENTAL RESULTS ARE PRESENTED WHICH VALIDATE THE THEORETICAL DISCUSSION. RESULTS OF ELECTRON BOMBARDMENT EXPERIMENTS ON P ON N AND N ON P SOLAR CELLS ARE GIVEN WHICH SHOW THE N ON P CELL STRUCTURE TO BE APPROXIMATELY FIVE TIMES MORE RESISTANT TO DAMAGE BY 2 MEV AND 700 KEV ELECTRONS. ELECTRON BOMBARDMENT EXPERIMENTS ON N ON P CELLS FABRICATED AT TRANSITRON ARE PRESENTED WHICH AGREE WITH THE RESULTS OBTAINED WITH THE SIGNAL CORPS N ON P CELLS. THE FABRICATION OF TRANSITRON RADIATION RESISTANT N ON P SOLAR CELLS IS DISCUSSED AND THE PROCESS AS DEVELOPED SO FAR IS GIVEN. (AUTHOR) (U)

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ODC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 257 495

TECHNICAL OPERATIONS INC BURLINGTON MASS

RESEARCH DETECTED TOWARD THE IMPROVEMENT OF THE
EFFICIENCY OF SILICON BATTERIES BY UTILIZATION OF
UNABSORBED PHOTONS

(U)

MAY 61 IV
REPT. NO. 861 24
CONTRACT: AF19 604 7306
MONITOR: AFCRL 475

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER SUPPLIES, *SILICON, *SOLAR CELLS,
ABSORPTION, COATINGS, DYES, EFFECTIVENESS, INFRARED
RADIATION, INSTRUMENTATION, PHOSPHORESCENT MATERIALS,
PHOTOGRAPHIC CHEMICALS, PHOTONS, REFLECTION,
SENSITIVITY, SOLAR RADIATION, SURFACES, TEST METHODS,
ULTRAVIOLET RADIATION

(U)

ATTEMPTS WERE MADE TO INCREASE THE POWER OUTPUT OF
SI SOLAR CELLS BY SENSITIZING THE CELLS TO THOSE
REGIONS IN WHICH THEY DO NOT RESPOND, (UV AND IR)
AND BY INCREASING THE ABSORPTION AND EFFICIENCY OF
THE CELLS IN THE SPECTRAL REGIONS IN WHICH THEY DO
RESPOND. THREE METHODS WERE STUDIED: (1)
COATING THE CELL SURFACE WITH PHOSPHORS WHICH ABSORB
IN THE UV AND BLUE REGION AND FLUORESED IN THE
REGION OF RESPONSE OF THE SOLAR CELL (0.45 TO 1.0
MICRONS) AND WITH DYE ENERGY-TRANSFER AGENTS;
(2) APPLYING ANTIREFLECTION COATINGS TO THE CELL
SURFACE FOR THE REGION OF RESPONSE; AND (3)
APPLYING DYE SENSITIZERS FOR THE IR REGION.
ADSORPTION AND RESPONSE OF SI SOLAR CELLS WAS
OPTIMIZED BY INDUSTRY IN THE REGION 0.45 TO 1.0
ANGSTROMS. SENSITIZATION OF THE CELLS BY PHOSPHORS
IN THE UV REGION IS FEASIBLE BUT THE INTENSITY OF
FLUORESCENCE REQUIRED TO DRIVE THE CELL APPEARS TO BE
GREATER THAN THAT EASILY ACHIEVED BY SURFACE COATING.
NEITHER SENSITIZATION BY CHEMICAL SENSITIZERS IN
THE UV REGION NOR BY DYE SENSITIZATION IN THE IR
REGION APPEARS TO BE POSSIBLE.

(U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 258 660

HOFFMAN ELECTRONICS CORP SANTA BARBARA CALIF

COATINGS FOR SOLAR CELLS

(U)

FEB 61

IV

WITUCKI, ROBERT M.; LEWIS, ARTHUR E.;

UNCLASSIFIED REPORT

DESCRIPTORS: *COATINGS, *INFRARED RADIATION, *OPTICAL COATINGS, *SOLAR CELLS, *THIN FILMS (STORAGE DEVICES), *ULTRAVIOLET RADIATION, ABSORPTION, BLACKBODY RADIATION, DIELECTRICS, INFRARED OPTICAL MATERIALS, MATERIALS, PLASTICS, POLYMERS, REFLECTION, REFLECTOMETERS, SEMICONDUCTORS, SILICONES, SPECTROPHOTOMETERS (U)

THE THEORETICAL BASIS FOR THE REFLECTANCE OF DIELECTRIC MATERIALS IN THE ULTRAVIOLET AND THE NEAR INFRARED WAS REVIEWED, AS WELL AS THE PROPERTIES REQUIRED FOR HIGH EMISSIVITY. IT WAS CONCLUDED THAT SINGLE THIN FILM COATINGS ALONE, OF 1 MICRON OR LESS IN THICKNESS, CAN NOT PROVIDE EITHER ADEQUATE EMISSIVITY OR HIGH SELECTIVE REFLECTIVITY OF THE WAVELENGTHS REQUIRED AND STILL SHOW HIGH TRANSMISSION FROM 0.45 TO 1.1 MICRON. A HIGH EMISSIVITY WAS FOUND TO BE THE MOST IMPORTANT SINGLE METHOD OF REJECTING ENERGY IN SPACE. THEREFORE ATTENTION WAS DIRECTED PRIMARILY TOWARD ACHIEVING MAXIMUM EMISSIVITY. EMISSIVITIES OF THE ORDER OF 0.9 CAN ONLY BE OBTAINED USING COATINGS OF SEVERAL MILS THICKNESS. SILICONE COATINGS WERE FOUND TO BE VERY SIMPLE AND INEXPENSIVE TO APPLY, AND WITHIN THE ACCURACY OF AVAILABLE DATA TO SHOW A PREDICTED PERFORMANCE IN SPACE EQUIVALENT TO THE PRESENTLY USED ULTRAVIOLET REFLECTING COATED COVER GLASSES. NUMEROUS LABORATORY TESTS OF LIMITED TIME DURATION HAVE SHOWN THE SELECTED SILICONE COATING TO BE STABLE TO THE EXPECTED ENVIRONMENTAL CONDITIONS DURING STORAGE AS WELL AS IN SPACE. (AUTHOR) (U)

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AD- 260 068
TRW INC CLEVELAND OHIO

DESIGN STUDY FOR ADVANCED SOLAR THERMIONIC POWER
SYSTEMS ITEM III. ELECTRICAL CHARACTERISTICS STUDY (U)

DEC 60 IV
REPT. NO. ER 4262
CONTRACT: AF33 616 7411

UNCLASSIFIED REPORT

DESCRIPTORS: *PLASMAS(PHYSICS), *POWER SUPPLIES, *SOLAR
CELLS, *THERMIONIC EMISSION, CESIUM, DESIGN, DIODES,
DIRECT CURRENT, EFFECTIVENESS, ELECTRICAL PROPERTIES,
ELECTRON IRRADIATION, GENERATORS, SOLAR RADIATION, SPACE
ENVIRONMENTS, TESTS, THEORY, VACUUM APPARATUS, VAPORS,
VOLTAGE REGULATORS (U)

RESULTS OF A THEORETICAL AND EXPERIMENTAL STUDY OF
ELECTRICAL CHARACTERISTICS OF CESIUM-VAPOR AND VACUUM
THERMIONIC GENERATORS ARE PRESENTED. THE RESULTS
INDICATE THAT A NON-OPTIMIZED CESIUM CONVERTER CAN
GIVE THE PREDICTED PERFORMANCE. A WIRE SPACER
TECHNIQUE FOR VACUUM DIODES WAS INVESTIGATED AND
PROVEN ENTIRELY SUCCESSFUL. THIS TECHNIQUE OFFERS
SUBSTANTIAL ADVANTAGES OVER SAPPHIRE SPACERS AND
SIMPLIFIES CONSIDERABLY THE DESIGN FOR THE 250-WATT
VACUUM GENERATOR. THE RESPONSE OF BOTH CESIUM AND
VACUUM GENERATORS TO SUDDEN CHANGES IN LOAD APPEARS
TO BE INSTANTANEOUS FOR ALL PRACTICAL PURPOSES,
THEREBY PERMITTING THE USE OF SWITCHING TYPE VOLTAGE
REGULATORS WHICH OFFER PARTICULAR ADVANTAGES IN SPACE
APPLICATIONS. (AUTHOR) (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 262 005

MOUNT VERNON RESEARCH CO ALEXANDRIA VA

SOLAR SPECTRUM SIMULATOR. SPACE ENVIRONMENT SIMULATOR
FOR TESTING SOLAR CELLS (U)

NOV 60 IV STICKNEY, WILLIAM W. I
CONTRACT: AF33 616 6935

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *SOLAR SPECTRUM, *SPACE
ENVIRONMENTS, ARGON, OPTICS, PLASMA JETS,
PLASMAS(PHYSICS), PRESSURE, QUARTZ, SIMULATION, TEST
METHODS, TESTS, THERMAL RADIATION, VACUUM APPARATUS (U)

A DEVICE IS TO BE DEVELOPED WHICH WILL SIMULATE THE
SPACE ENVIRONMENT SO THAT THE PERFORMANCE IN SPACE OF
SOLAR CELLS AND ARRAYS OF THEM CAN BE REALISTICALLY
EVALUATED IN THE LABORATORY. THE ENVIRONMENT
INCLUDES THREE BASIC PARAMETERS: SOLAR RADIATION,
PRESSURE, AND THERMAL CONDITIONS. AN ARGON
STABILIZED, DC, PLASMA ARC WAS DEVELOPED AS A LIGHT
SOURCE TO SIMULATE THE SOLAR RADIATION IN BOTH COLOR
DISTRIBUTION AND INTENSITY FROM 0.2 TO 2.0 MICRONS
WAVELENGTH. A VACUUM CHAMBER WITH LIQUID NITROGEN
COOLED WALLS WAS BUILT TO SIMULATE THE EFFECTS ON
SOLAR CELLS OF PRESSURE AND THERMAL CONDITIONS IN
SPACE. (AUTHOR) (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 263 861

IIT RESEARCH INST CHICAGO ILL

INVESTIGATION OF SINGLE ENERGY GAP SOLAR CELL
MATERIAL

(U)

JUN 61 IV ROBINSON, ROBERT J.:
REPT. NO. 1175 10
CONTRACT: DA36 039SC87381
MONITOR: ARPA 80 61

UNCLASSIFIED REPORT

DESCRIPTORS: •MANUFACTURING, •POWER SUPPLIES, •SOLAR
CELLS, CADMIUM COMPOUNDS, CONTROLLED ATMOSPHERES,
CRYSTALS, DESIGN, DIFFUSION, ELECTRICAL PROPERTIES, HIGH
TEMPERATURE, INTERMETALLIC COMPOUNDS, MATERIALS, OPTICS,
PROCESSING, PRODUCTION, SEMICONDUCTORS, SINGLE CRYSTALS,
TELLURIDES, TESTS, THERMAL STRESSES (U)

EMPHASIS WAS PLACED ON FORMING P-TYPE LAYERS ON N-
TYPE ZONE LEVELED CDTE BY VAPOR DIFFUSION IN THE
RECENTLY ACQUIRED MULTIPLE ZONE FABRICATION FURNACE.
LOW TEMPERATURE DIFFUSION FABRICATION STUDIES WERE
EMPHASIZED AND IT IS SHOWN THAT SHALLOW AND DEEP
JUNCTIONS CAN BE FORMED AT 500 C. ELECTRICAL,
THERMAL AND OPTICAL STUDIES OF THE N-TYPE BASE
MATERIAL, AND SPECTRAL RESPONSE CURVES OF THE
COMPLETED SOLAR CELLS ARE INCLUDED. COMBINED
OPTICAL TRANSMISSION AND SPECTRAL RESPONSE CURVES
SHOW THAT THE ABSORPTION COEFFICIENT VERSUS
WAVELENGTH HAS A SLOPE SIMILAR TO SILICON RATHER THAN
TO GAAS OR INP WHICH IS FAVORABLE. LOW
TEMPERATURE FABRICATION IS SHOWN TO BE POSSIBLE AND
IS ADVANCED AS AN ARGUMENT FOR CDTE SINCE LESS
FABRICATION DISORDER IS EXPECTED COMPARED TO HIGH
TEMPERATURE FABRICATION. HOWEVER, THE ROOM
TEMPERATURE CONVERSION EFFICIENCIES OF CURRENT
CDTE SOLAR CELLS ARE STILL LOW COMPARED TO
SILICON, BUT THE STILL EARLY STATE OF THE ART OF
CDTE IS STRESSED. PRELIMINARY HIGH TEMPERATURE
PHOTOVOLTAIC EXPERIMENTS TEND TO CONFIRM THE USE OF
CDTE COMPARED TO SILICON. (AUTHOR) (U)

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AD- 265 213

LOCKHEED MISSILES AND SPACE CO SUNNYVALE CALIF

PROTON DAMAGE TO SOLAR CELLS

(U)

AUG 61 1V CHOW, K.T.; LODI, E.A.;
REPT. NO. LMSD 703735 1
CONTRACT: AFO4 647 564

UNCLASSIFIED REPORT

DESCRIPTORS: *DAMAGE, *RADIATION EFFECTS, *SOLAR CELLS,
*SPACE ENVIRONMENTS, INSTRUMENTATION, POWER SUPPLIES,
PROTON BEAMS, PROTONS, RADIOACTIVATION ANALYSIS,
SILICON, SIMULATION

(U)

THE PERFORMANCE WAS EVALUATED OF COMMERCIALY
AVAILABLE SILICON SOLAR CELLS WHICH ARE TO BE USED AS
A POWER SOURCE IN THE SPACE RADIATION FIELD
SURROUNDING THE EARTH. THE EXPERIMENT WAS
SPECIFICALLY DESIGNED TO PROVIDE INFORMATION ON THE
PROTON RADIATION ENCOUNTERED BY SOLAR CELLS
OPERATING IN SPACE. THE RESULTS INDICATED THAT A
25% REDUCTION IN MAXIMUM POWER OUTPUT OF THE CELL
OCCURRED AT INTEGRATED FLUXES OF APPROXIMATELY 5×10
TO THE 9TH AND 10TH POWER PROTONS/SQ CM FOR 3-MEV
AND 13-MEV PROTONS, RESPECTIVELY. THE CELLS WERE
FURTHER IRRADIATED TO OBTAIN A REDUCTION IN MAXIMUM
POWER OUTPUT OF ABOUT 40 TO 50%. ROOM-TEMPERATURE
ANNEALING OF THE CELLS WAS OBSERVED FOR A PERIOD OF
FOUR WEEKS WITH NO SIGNIFICANT CHANGES OCCURRING.
THE PROTON SOURCE, THE APPARATUS FOR MEASURING THE
ELECTRICAL OUTPUT OF THE SOLAR CELL, AND THE RESULTS
OF THE EXPERIMENT ARE PRESENTED. (AUTHOR)

(U)

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AD- 269 508

ELECTRO-OPTICAL SYSTEMS INC PASADENA CALIF

CHEMICAL REACTIONS TO CONVERT SOLAR ENERGY INTO POWER
SOURCES (U)

SEP 61 1V ROWLETTE, J.J. ;
CONTRACT: AF33 616 6546
MONITOR: ARL 60

UNCLASSIFIED REPORT

DESCRIPTORS: *OXIDES, *POWER SUPPLIES, *SOLAR CELLS,
*SOLAR RADIATION, *SULFUR COMPOUNDS, CADMIUM COMPOUNDS,
CATALYSTS, CHEMICAL REACTIONS, DECOMPOSITION,
ELECTROLYTIC CELLS, GASES, HYDROGEN, LABORATORY
EQUIPMENT, LIQUIDS, PEROXIDES, PHOTOCHEMICAL REACTIONS,
REGENERATION, SYNTHESIS, TELLURIDES, TEMPERATURE,
THERMOCHEMISTRY, ZINC COMPOUNDS (U)

PHOTOCHEMICAL SYNTHESIS OF H₂O₂ AND THE
COMBINED THERMAL-PHOTOCHEMICAL DECOMPOSITION WERE
STUDIED FOR THE ULTIMATE POSSIBILITY OF USING
SUNLIGHT FOR REGENERATIVE ELECTROLYTIC CELLS, OR FOR
THE PURPOSE OF MAKING H₂O₂ FOR OTHER HIGH ENERGY
APPLICATIONS. THEORETICAL ANALYSIS OF THE
PHOTOLYSIS AND THERMAL DECOMPOSITION OF SO₃
STRONGLY INDICATED THAT A COMBINATION OF A
PHOTOCHEMICAL AND THERMAL DECOMPOSITION WOULD NOT
YIELD A DECOMPOSITION GREATER THAN THE 2 PROCESSES
USED SEPARATELY. H₂O₂ SYNTHESIS WAS ACCOMPLISHED
IN BOTH LIQUID AND GASEOUS STATES USING CADMIUM
TELLURIDE AND ZINC OXIDE AS PHOTOCATALYST. WITHOUT
ORGANIC ADDITIVES IN THE LIQUID PHASE, NEITHER
CATALYST SHOWS ANY PROMISE. IN THE PRESENCE OF THE
ADDITIVES, THE REACTIONS ARE ALWAYS EXOTHERMIC AND
CONSEQUENTLY OF NO VALUE FOR ENERGY CONVERSION.
(AUTHOR) (U)

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AD- 270 131

RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC
PRODUCTS

SOLAR CELL ARRAY OPTIMIZATION

(U)

NOV 61 1V ADDISS, R.R. IANCHUTIN, A. I
CONTRACT: AF33 616 7415
MONITOR: ASD TR61 11

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, ADHESIVES, AIRBORNE, CADMIUM
COMPOUNDS, COATINGS, MATERIALS, PHOTOELECTRIC CELLS
(SEMICONDUCTOR), PHOTOTUBES, PLASTICS, POWER SUPPLIES,
RELIABILITY, SINGLE CRYSTALS, SULFIDES (U)

PRELIMINARY SPECIFICATIONS ARE GIVEN FOR TWO
OPTIMIZED SOLAR-CELL-ARRAY SYSTEMS. THE PRIMARY
OPTIMIZATION CRITERION APPLIED WAS TO OBTAIN THE
MAXIMUM ELECTRICAL POWER CONVERSION OF SOLAR ENERGY
IN SPACE PER UNIT OF SYSTEM WEIGHT, CONSISTENT WITH
REQUIRED MINIMUM RELIABILITY AND MAXIMUM PERMISSIBLE
PACKAGED VOLUME. SPECIFIC AREAS CONSIDERED ARE,
PHOTOVOLTAIC MATERIALS, CRYSTAL CONVERSION, SOLAR
CELL CIRCUIT SIMULATION, ARRAY INTERCONNECTION
OPTIMIZATION, ADHESIVES, ARRAY STRUCTURES, FOAM
INFLATION, THERMAL DESIGN, TEMPERATURE AND INTENSITY
EFFECTS, AND LAUNCH ENVIRONMENT. (AUTHOR) (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 271 358
SPECTROLAB SYLMAR CALIF

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR
CELLS

(U)

DEC 60 IV MANN, A.E.;

UNCLASSIFIED REPORT

DESCRIPTORS: *INFRARED FILTERS, *OPTICAL COATINGS, *RARE
EARTH COMPOUNDS, *SOLAR CELLS, ADHESIVES, BETA
PARTICLES, BLACKBODY RADIATION, BONDING, COATINGS,
FLUORIDES, INFRARED RADIATION, OXYFLUORIDES, POWER
SUPPLIES, RADIATION EFFECTS, RARE EARTH ELEMENTS,
REFLECTION, SATELLITES (ARTIFICIAL), SILICON, SPACE
ENVIRONMENTS, STABILITY, TESTS, THEORY, THERMODYNAMICS,
VAPOR PLATING, WAVE PROPAGATION (U)

THE USE OF SPECTRALLY SELECTIVE COATINGS AS FILTERS
FOR SI SOLAR CELLS IS UNDER INVESTIGATION WITH
PRIMARY EMPHASIS ON AUXILIARY POWER SYSTEMS FOR SPACE
VEHICLES. A GENERAL STUDY OF THE THERMAL BALANCE
OF A SOLAR PANEL IN SPACE AND THE RESULTANT EFFECT ON
ARRAY EFFICIENCY WERE EXAMINED. THE DIFFUSE
SPECTRAL REFLECTANCES AND SPECTRAL SENSITIVITIES OF
TYPICAL SI CELLS ARE BEING REDETERMINED. THE
PHYSICAL PROPERTIES AND ENVIRONMENTAL CHARACTERISTICS
OF STATE-OF-THE-ART COATINGS ARE BEING STUDIED AND
MEASUREMENTS OF THE SPECTRAL TRANSMITTANCE,
REFLECTANCE AND EMITTANCE FOR CELL COATINGS ARE BEING
OBTAINED. ENVIRONMENTAL TESTS INCLUDED HUMIDITY,
HIGH- AND LOW-TEMPERATURE STORAGE, TEMPERATURE SHOCK,
VACUUM STORAGE AND UV AND BETA IRRADIATION.
ADAPTATION OF THE SPECTROLAB IR WINDOW COATING
TO SI SOLAR CELLS IS BEING STUDIED. (AUTHOR) (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 271 599
SPECTROLAB SYLMAR CALIF

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR
CELLS

(U)

JUN 60 IV MANN, A.E.;
CONTRACT: DA36 039SC85284
MONITOR: ARPA 80 59

UNCLASSIFIED REPORT

DESCRIPTORS: *OPTICAL COATINGS, *SOLAR CELLS, GLASS,
POWER SUPPLIES, PROTECTIVE COVERINGS, SEMICONDUCTORS,
SOLAR RADIATION, TESTS

(U)

THE USE OF SPECTRALLY SELECTIVE COATINGS AS
FILTERS FOR SILICON SOLAR CELLS WAS STUDIED. THE
THERMAL BALANCE OF A SOLAR PANEL IN SPACE AND THE
RESULTANT EFFECT ON ARRAY EFFICIENCY WAS EXAMINED; A
SPECIFIC EXAMPLE IS STUDIED. THE PHYSICAL
PROPERTIES AND ENVIRONMENTAL CHARACTERISTICS OF
STATE-OF-THE-ART COATINGS WERE STUDIED.
MEASUREMENTS OF THE SPECTRAL TRANSMITTANCE,
REFLECTANCE AND EMITTANCE FOR COATED CELLS WERE
OBTAINED. ENVIRONMENTAL TESTS INCLUDED HUMIDITY,
HIGH AND LOW TEMPERATURE STORAGE, TEMPERATURE SHOCK,
VACUUM STORAGE, AND ULTRAVIOLET AND BETA IRRADIATION.
(AUTHOR)

(U)

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AD- 273 551

GOODYEAR AEROSPACE CORP AKRON OHIO

SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL
ARRAY

(U)

JAN 62 IV MCKEEL, G.J.:

UNCLASSIFIED REPORT

DESCRIPTORS: *ELECTRIC POWER PRODUCTION, *SOLAR CELLS,
DESIGN, DETECTION, ENERGY CONVERSION, FEASIBILITY
STUDIES, FOCUSING, POWER SUPPLIES, ROTATING STRUCTURES,
SENSITIVITY, SOLAR RADIATION, SUN, TESTS, THERMAL
RADIATION, TRACKING (U)
IDENTIFIERS: ROTATING STRUCTURES (M)

THE EFFECTS OF SOLAR DECLINATION CHANGE ON THE
TOTAL ANGULAR ERROR OF THE ARRAY AND THE POSITION FOR
MOUNTING THE SUN SENSOR ARE TREATED. CURVES OF
TOTAL ANGULAR ERROR VERSUS DECLINATION CHANGE FOR
VARIOUS VALUES OF THE TRACKING DRIVE ERROR ARE
PRESENTED. AN EXAMPLE IS OUTLINED FOR CALCULATING
THE POSSIBLE PERIOD OF UNATTENDED OPERATION OF THE
SOLAR ORIENTING DEVICE AND ITS ARRAY FOR A PARTICULAR
SET OF INITIAL CONDITIONS WHICH CONTAIN A CONSTANT
DECLINATION VALUE. THE TRACKING RATE FOR THE ARRAY
IS EXAMINED TO OBTAIN AN INSIGHT INTO SOME OF THE
IMPORTANT PARAMETERS AFFECTING ITS OPERATION. THE
REQUIREMENTS FOR AUTOMATIC DECLINATION CONTROL
APPLICABLE TO THE SOLAR ORIENTING DEVICE WERE
EXAMINED, AND A FEASIBLE APPROACH TO THE SENSOR IS
PRESENTED. A CIRCUIT DIAGRAM ILLUSTRATES THE
ADDITIONAL HARDWARE NEEDED FOR TWO-AXIS AUTOMATIC
CONTROL. SENSOR MODIFICATION IS DISCUSSED FOR THE
PURPOSE OF REMOVING THE DEAD ZONE WHICH, UNDER
CERTAIN TRACKING CONDITIONS, CAN OCCUR.
EXPERIMENTAL RESULTS GAINED FROM THE BREADBOARD
MODEL OF THE MOUNT AND DRIVE UNIT ARE GIVEN, AND THE
SUN SENSOR ACCURACY IS ALSO OBTAINED. PHOTOGRAPHS
OF THE BREADBOARD MOUNT AND SUN SENSOR ARE INCLUDED.
(AUTHOR) (U)

UNCLASSIFIED

NDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 274 481

LOCKHEED MISSILES AND SPACE CO SUNNYVALE CALIF

SOLAR REGENERATIVE CHEMICAL SYSTEM

(U)

DEC 61 IV GANDEL, M.G.;
REPT. NO. 2 52 61 2
CONTRACT: DA36 039SC85245

UNCLASSIFIED REPORT

DESCRIPTORS: *CADMIUM COMPOUNDS, *FUEL CELLS, *IODIDES,
*POWER SUPPLIES, *SOLAR CELLS, *TIN COMPOUNDS, BROMIDES,
COPPER COMPOUNDS, DISSOCIATION, DYES, ELECTROCHEMISTRY,
ENERGY CONVERSION, LEAD COMPOUNDS, PHOTOCHEMICAL
REACTIONS, PHOTSENSITIVITY, SOLAR RADIATION,
TEMPERATURE, THERMOCHEMISTRY, THERMODYNAMICS

(U)

A REGENERATIVE-TYPE FUEL CELL, WITH REGENERATION
BASED ON THE THERMAL DISSOCIATION OF CdI_2 OR
 SnI_2 , WAS SHOWN TO BE UNFEASIBLE. THE
THEORETICAL EVALUATION OF THE THERMODYNAMICS AND
HIGH-TEMPERATURE KINETICS OF BOTH SYSTEMS SUPPORTS
THE NEGATIVE EXPERIMENTAL FINDINGS. THE METAL-
MOLTEN SALT THERMOCELL WAS BASED ON A LARGE THERMAL
GRADIENT ACROSS THE ELECTROLYTE WHICH GENERATES A
POTENTIAL BETWEEN HOT AND COLD METAL TO ELECTROLYTE
JUNCTIONS. THE VALUES OF dE/dT (IN MICRO V/
DEG), THE CHANGE OF POTENTIAL WITH TEMPERATURE
DIFFERENTIAL, WERE EXPERIMENTALLY DETERMINED AND
RANGED FROM -30 TO -100. A SYSTEM IS SOUGHT WHERE
 dE/dT IS ON THE ORDER OF SEVERAL HUNDRED MICRO V/
DEG. THE DOUBLE THERMOGALVANIC CELL UTILIZES AN
ELECTROLYTIC CELL OPERATING AT ELEVATED TEMPERATURE,
TO REGENERATE THE REACTION PRODUCTS OF A FUEL CELL.
ELECTROLYSIS OF CdI_2 WAS PERFORMED WITH
APPROXIMATELY 40-8 CURRENT EFFICIENCY; THE LOW
CURRENT EFFICIENCY WAS ATTRIBUTED TO THE SOLUBILITY
OF MOLTEN Cd IN THE FUSED SALT. PHOTOCHEMICALLY
REGENERATIVE SYSTEMS BASED ON THE REVERSIBLE
PHOTOCHEMICAL BLEACHING OF WATER-SOLUBLE DYES WERE
STUDIED. THE PROFLAVINE-ASCORBIC ACID SYSTEM WAS
FOUND TO BE THE MOST SUCCESSFUL. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 274 841

RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC
PRODUCTS

SOLAR CELL ARRAY OPTIMIZATION, VOLUME II

(U)

FEB 62 IV
REPT. NO. TR61 11 V2
CONTRACT: AF33 616 7415
MONITOR: ASD TR61 11 V2

UNCLASSIFIED REPORT

DESCRIPTORS: *ELECTRIC POWER PRODUCTION, *SOLAR CELLS,
ADHESIVES, AIRBORNE, CADMIUM COMPOUNDS, COATINGS, ENERGY
CONVERSION, MATERIALS, PHOTOELECTRIC CELLS
(SEMICONDUCTOR), PHOTOTUBES, PLASTICS, POWER SUPPLIES,
DAMAGE, RADIATION EFFECTS, RELIABILITY, SINGLE CRYSTALS,
SULFIDES, THIN FILMS (STORAGE DEVICES) (U)
IDENTIFIERS: THIN FILMS, THIN FILM ELECTRONICS (H)

THE ANALYSIS COVERS THE FABRICATION AND TEST OF
PHOTOVOLTAIC MATERIALS AND DESIGN OF SOLAR-CELL
ARRAYS FOR MAXIMUM CONVERSION OF SOLAR ENERGY WITH
MINIMUM WEIGHT. EVAPORATED LAYER CELLS WITH AN
EFFICIENCY OF UP TO 4.5 PERCENT OVER AN AREA OF 1.6
SQ CM WERE FABRICATED. RESEARCH ON CRYSTAL LAYER
CONVERSION REDUCED THE TEMPERATURE FOR
RECRYSTALLIZATION FROM 500 C TO 300 C. TWO
MODELS OF SOLAR-CELL ARRAYS TO SIMULATE A 100 SQ FT
SYSTEM WERE FABRICATED: THE TELE COPING SAIL WITH A
DENSITY OF 0.075 LB SQ FT., AND THE INFLATABLE TORUS
SAIL WITH A DENSITY OF 0.04 LB SQ FT. THE MAXIMUM
AREA OF INDIVIDUAL CELLS WAS INCREASED BY A FACTOR
OF 27, THICKNESS OF SUBSTRATE REDUCED BY FACTOR OF 6,
AND WEIGHT REDUCED BY FACTOR OF 7. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 281 829

HOFFMAN ELECTRONICS CORP EL MONTE CALIF

DESIGN STUDY OF SOLAR ENERGY MEASUREMENT
TECHNIQUES.

(U)

DESCRIPTIVE NOTE: INTERIM REPT., MAR 61-15 JAN 62,
JUN 62 63P ROSS, BERND BICKLER, D. B.

REPT. NO. TN61 156

CONTRACT: AF33 616 7946

PROJ: 3145

MONITOR: ASD TN61 156

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, CALIBRATION, COMPUTERS,
INSTRUMENTATION, LIGHT, TESTS
IDENTIFIERS: SPECTRA

(U)

(M)

A NEW PRIMARY STANDARD SOLAR CELL CALIBRATION
PROCEDURE HAS BEEN DEFINED WHICH IS EXPECTED TO
PROVIDE A MORE NEARLY ABSOLUTE BASIS FOR DETERMINING
SOLAR CELL PERFORMANCE. A PRELIMINARY DESIGN FOR A
PORTABLE TESTER IS SET FORTH, THE PURPOSE OF WHICH IS
TO MEASURE THE OUTPUT OF SOLAR CONVERTER POWER
SUPPLIES UNDER A WIDE RANGE OF RADIATION CONDITIONS
AND EXTRAPOLATE TO SPACE SOLAR RADIATION CONDITIONS.
DATA ON SOLAR CELL PERFORMANCE PARAMETERS,
CURRENTS, VOLTAGES, ETC., AS A FUNCTION OF RADIANT
ENERGY INTENSITY AND TEMPERATURE ARE PRESENTED.
SPECTRAL RESPONSE DATA ARE PRESENTED. (AUTHOR)

(M)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 282 219

RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC
PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE
RADIATION-RESISTANT SOLAR-CELL ARRAY.

(U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.
1, MAY-JUL 62.

AUG 62 14P

REPT. NO. AED-1558

CONTRACT: AF 33(657)-8490

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLAR CELLS), GALLIUM COMPOUNDS,
ARSENIDES, HEAT RESISTANT ALLOYS, HIGH TEMPERATURE
RESEARCH, DAMAGE, RADIATION EFFECTS, MEASUREMENT, TESTS,
ABSORPTION, SATELLITES(ARTIFICIAL), MANUFACTURING,
PROCESSING

(U)

EFFORT WAS MADE TO DETERMINE THE TECHNOLOGY
NECESSARY FOR THE APPLICATION OF A HIGH-TEMPERATURE,
RADIATION-RESISTANT ARRAY OF SOLAR CELLS IN A
CONFIGURATION SUITABLE TO AEROSPACE VEHICLES.
TOWARD THIS END, GALLIUM ARSENIDE SOLAR CELLS ARE
BEING FABRICATED FOR TEMPERATURE AND RADIATION TESTS,
AND EXPERIMENTAL STUDIES ARE BEING CONDUCTED TO
DETERMINE TECHNIQUES FOR FABRICATING MODULES AND
ARRAYS. THE CHOICE OF GALLIUM ARSENIDE SOLAR CELLS
FOR THIS PROGRAM WAS DICTATED BY THE SUPERIOR HIGH-
TEMPERATURE AND RADIATION-RESISTANCE CHARACTERISTICS
OF GALLIUM ARSENIDE AS COMPARED WITH SILICON.
THESE TWO MATERIALS ARE THE ONLY ONES WHICH HAVE
BEEN EXTENSIVELY DEVELOPED FOR SOLAR CELL USE. THE
BASIC PROPERTIES OF SILICON AND GALLIUM ARSENIDE ARE
SHOWN. IT SHOULD BE NOTED THAT GALLIUM ARSENIDE
HAS A LARGER BAND GAP, HIGHER ELECTRON AND HOLE
MOBILITY, AND A HIGHER ATOMIC MASS THAN SILICON.
THE HIGHER BAND GAP ACCOUNTS FOR THE BETTER HIGH-
TEMPERATURE PERFORMANCE OF GALLIUM ARSENIDE CELLS.
THE HIGHER MOBILITIES RESULT IN LOWER INTERNAL
ELECTRICAL RESISTANCE AND THE HIGHER MASS CONTRIBUTES
TO A BETTER RADIATION RESISTANCE. GALLIUM ARSENIDE
CELLS HAVE A POTENTIALLY HIGHER CONVERSION
EFFICIENCY, BASED ON THEORETICAL CONSIDERATIONS.
BECAUSE OF THEIR EARLIER DEVELOPMENT, SILICON CELLS
PRESENTLY HAVE A SOMEWHAT HIGHER EFFICIENCY.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 284 032

HARSHAW CHEMICAL CO CLEVELAND OHIO

RESEARCH ON SOLAR-ENERGY CONVERSION EMPLOYING CADMIUM
SULFIDE (U)

APR 62 IV SHIRLAND, FRED A.; WOLFF, G. A.; NIXON,
JOHN D.;
REPT. NO. 4
CONTRACT: DA36 D39SC87289
MONITOR: ASD TDR-62-69

UNCLASSIFIED REPORT

DESCRIPTORS: *CADMIUM COMPOUNDS, *SOLAR CELLS, *SOLAR
RADIATION, FILMS, MANUFACTURING, SEMICONDUCTORS, SINGLE
CRYSTALS, SULFIDES (U)

RESEARCH ON SOLAR ENERGY CONVERSION EMPLOYING CDS
GROWTH, ANNEALING, ETCHING AND ORIENTATION OF CDS
SINGLE CRYSTALS AND FILMS.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 285 315

WESTINGHOUSE ELECTRIC CORP DAYTON OHIO

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM (U)

AUG 62 1V
CONTRACT: AF33 657 8162

UNCLASSIFIED REPORT

DESCRIPTORS: *ARSENIDES, *GALLIUM COMPOUNDS, *LABORATORY
FURNACES, *SOLAR CELLS, CRUCIBLES, DESIGN, DIFFUSION,
EXPLOSIONS, INTERMETALLIC COMPOUNDS, MATERIALS,
PHOSPHORUS, SINGLE CRYSTALS, TEMPERATURE CONTROL,
ZINC (U)

A 7 IN. EXPLORATORY DENDRITE PULLING FURNACE WAS
PUT INTO OPERATION. CONSTRUCTION OF A 24 IN.
PULLER CONTINUES. GAAS SOLAR CELLS WERE MADE BY
AN OPEN TUBE DIFFUSION PROCESS. PRELIMINARY
RESULTS HAVE BEEN OBTAINED IN AN INVESTIGATION OF THE
FEASIBILITY OF PRODUCING A GRADED BAND GAP BY OPEN
TUBE DIFFUSION OF P INTO GAAS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 286 578

FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

SOLAR BATTERIES OF THE FUTURE

(U)

SEP 62 1V KOLTUN, M.;
REPT. NO. TT 62 972

UNCLASSIFIED REPORT

DESCRIPTORS: *FUEL CELLS, *POWER SUPPLIES, *SOLAR CELLS,
*SOLAR RADIATION, INTERMETALLIC COMPOUNDS, PHOTOELECTRIC
CELLS (SEMICONDUCTOR), PHOTOTUBES, SILICON (U)

THE CONVERSION OF HELIOENERGETICS INTO AN
INDEPENDENT AND IMPORTANT TECHNOLOGICAL FIELD IS
DISCUSSED. OUTSTANDING SCIENTISTS OF THE WORLD,
INCLUDING FREDERIC JOLIOY-CURIE, FEEL THAT
HELIOENERGETICS WILL BE PUT ON AN EQUAL FOOTING WITH
THE STUDY OF ATOMIC ENERGY. IN THIS CONNECTION
SCIENTISTS AWAIT FURTHER RESEARCH. (AUTHOR) (U)

UNCLASSIFIED

ODC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 287 570

RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC
PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE
RADIATION-RESISTANT SOLAR-CELL ARRAY

(U)

OCT 62 IV

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, ARSENIDES, DESIGN, ELECTRIC
CONNECTORS, ELECTRIC CURRENTS, GALLIUM COMPOUNDS,
MEASUREMENT, MECHANICAL PROPERTIES, RADIATION EFFECTS,
SILICON, SOLDERED JOINTS, TESTS (U)

PRODUCTION AND TESTING OF GAAS SOLAR CELLS.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 292 709

WESTINGHOUSE ELECTRIC CORP DAYTON OHIO

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM (U)

NOV 62 IV

UNCLASSIFIED REPORT

DESCRIPTORS: *ARSENIDES, *GALLIUM COMPOUNDS, *SINGLE
CRYSTALS, *SOLAR CELLS, CRYSTAL OVENS, CRYSTALS,
EPITAXIAL GROWTH, INTERMETALLIC COMPOUNDS (U)
IDENTIFIERS: DENDRITES(CRYSTALLOGRAPHY) (M)

DENDRITIC GAAS MATERIAL HAS BEEN OBTAINED FROM
A 7-IN. EXPLORATORY PULLING FURNACE. THE
TECHNIQUES LEARNED FOR STOICHIOMETRY AND TEMPERATURE
CONTROL ARE BEING APPLIED IN THE CONSTRUCTION OF A
14- AND A 24-IN. PULLING FURNACE REPRODUCIBILITY
OF RESULTS HAS BEEN IMPROVED IN THE OPENTUBE
DIFFUSION PROCESS. DETECTION OF PARTIAL SURFACE
CONVERSION OF GAAS TO GAP BY A REFLECTION
METHOD HAS BEEN EXPLORED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 293 831

RADIO CORP OF AMERICA SOMERVILLE N J

GALLIUM ARSENIDE SOLAR CELL PRODUCTION PROCESSES AND
TECHNIQUES (U)

DEC 62 IV BERTRAM, H.; GIBBONS, L. H.;
CONTRACT: AF 33(657)-8921

UNCLASSIFIED REPORT

DESCRIPTORS: *ARSENIDES, *GALLIUM COMPOUNDS, *POWER
SUPPLIES, *SOLAR CELLS, COATINGS, COPPER, CRYSTALS,
DIFFUSION, ELECTRIC POTENTIAL, GOLD, GROWTH(PHYSIOLOGY),
MANUFACTURING, MONOXIDES, NICKEL, PLATING, REFLECTION,
RUPTURE, SILICON COMPOUNDS, SIMULATION, SINGLE CRYSTALS,
SOLAR RADIATION, SOLDERING ALLOYS (U)

EFFORTS TO IMPROVE THE YIELD OF LARGE AREA SINGLE
CRYSTAL GALLIUM ARSENIDE AS WELL AS SUPPLYING
CRYSTAL FOR SOLAR CELL FABRICATION CONTINUED.
SEVERAL STEPS IN THE SOLAR CELL FABRICATION
PROCESS, CURRENTLY IN USE, WERE EXAMINED CAREFULLY IN
AN ATTEMPT TO IMPROVE CELL EFFICIENCY OR INCREASE THE
POTENTIAL PRODUCTION RATE. CONSIDERABLE ATTENTION
WAS DEVOTED TO THE MEANS FOR APPLYING SOLDER
CONTACTS TO THE SOLAR CELL. STUDIES WERE MADE OF
VARIOUS WAFER POLISHING TECHNIQUES AND THEIR EFFECT
ON CELL EFFICIENCY; THE DEPOSITION OF A SILICON
MONOXIDE ANTIREFLECTION COATING ON WAFERS; THE
EVALUATION OF SOLAR CELL P-N JUNCTION CHARACTERISTICS
USING PILOT LINE CELLS; AND SOLAR SIMULATION. (AUT
OR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 294 016
HARSHAW CHEMICAL CO CLEVELAND OHIO

LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY
INVESTIGATION (U)

JAN 63 IV SHIRLAND, F.A.; SCHAEFER, J.C.;
CONTRACT: AF33 657 9975

UNCLASSIFIED REPORT

DESCRIPTORS: *AUXILIARY POWER PLANTS, *POWER SUPPLIES,
*SOLAR CELLS, ACCELERATION, CADMIUM COMPOUNDS, DESIGN,
LAMINATES, PHOTOELECTRIC CELLS (SEMICONDUCTOR),
PHOTOTUBES, PLASTICS, SHEETS, SHOCK RESISTANCE, SINGLE
CRYSTALS, SULFIDES, TEMPERATURE, TESTS, THIN FILMS
(STORAGE DEVICES) (U)

THE MAJOR FACTOR OW PREVENTING THE USE OF E
CDS FILM SOLAR CELL AS PHOTOVOLTAIC CONVERTER
FOR PCUILLARY POWER SYSTEMS IS THAT IT IS UN
ES UNPROVEN IN THE SPACE ENVIRONMENT. THE
GOAL OF THE CDS FILM CELL UNDER THE CONDITIONS OF
SPACE AND THE CONDITIONS THAT WOULD BE ENCOUNTERED IN
GETTING ARRAYS INTO SPACE IS THE PRINCIPAL OBJECTIVE
ECOLOGY OBJECTIVES ARE TO IMPROVE THE PERFORMANCE
OF THE CDS FILM CELL AND TO OBTAIN
UNDERSTANDING OF THE FUNDAMENTAL GOVERNING THE
OPERATION OF THE CELL. FULL SCALE EFFORTS WERE
EXERTED ON THE DESIGN OF CDS FILM CELL ARRAYS ON
STABILITY, USE AND ENVIRONMENTAL AND PERFORMANCE T
STING AND ON THE CONSTRUCTION OF CELL ARRAYS
FOR HE ORBITAL EVALUATION PANELS. A FINAL DESIGN
OF CDS FILM CELL ARRAYS FOR HE ORBITAL TEST WAS
EVOLVED, AND ARRAYS OF THIS DESIGN SUCCESSFULLY MET
REQUIREMENTS FOR SHOCK, ACCELERATION AND T
EMPERATURE CYCLING WITH NO DISCRIBIBLE ILL EFFECT.
A STOCK PILE OF LARGE AREA CDS FILM CELLS OF GR
ATER THAN 80% EFFICIENCY WAS BUILT UP.
AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 295 056

TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS

(U)

SEP 62 IV BERMAN, PAUL A.; HANDY, ROLAND J.;
PERRY, G.;
CONTRACT: DA36 039SC90777

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER SUPPLIES, *SILICON, CIRCUITS,
CONFIGURATION, CRYSTALS, DESIGN, DIFFUSION, ELECTRICAL
PROPERTIES, INTENSITY, LIGHT, MANUFACTURING, MIRRORS,
PHOTOELECTRIC CELLS (SEMICONDUCTOR), PHOTOTUBES,
RESISTANCE (ELECTRICAL), SOLAR CELLS, SOLAR
RADIATION

(U)

PRELIMINARY EXPERIMENTS WERE PERFORMED ON N/P
AND P/N CELLS HAVING VARIOUS JUNCTION DEPTHS TO
DETERMINE THE EFFECTS OF LIGHT INTENSITY ON CELL
PERFORMANCE FOR VARIOUS CELL CONFIGURATIONS.
PRELIMINARY RESULTS INDICATED THAT CELLS DIFFUSED
TWICE AS LONG AS STANDARD PRODUCTION-TYPE CELLS
OPERATE MORE EFFICIENTLY AT THE HIGHER SOLAR
INTENSITIES. THE SHALLOW DIFFUSED CELLS HAD HIGHER
SHORT CIRCUIT CURRENTS INDICATING HIGHER POTENTIAL
EFFICIENCIES WITH THE USE OF OPTIMIZED GRID DESIGNS
TO FURTHER REDUCE SERIES RESISTANCE. THEORETICAL
CALCULATIONS WERE CARRIED OUT TO DETERMINE THE
OPTIMUM GRID CONFIGURATION FOR SHALLOW-DIFFUSED
CELLS. RESULTS INDICATED THAT THE OPTIMUM GRID
SPACING IS VERY INSENSITIVE TO CHANGES IN LIGHT LEVEL
IF ALL OTHER VARIABLES ARE HELD CONSTANT. THE GRID
SPACING DOES, HOWEVER, CHANGE SIGNIFICANTLY WITH
VARIOUS A-FACTOR VALUES. POSSIBLY THROUGH THIS
MECHANISM THE OPTIMIZED GRID SPACING CHANGES AS A
FUNCTION OF LIGHT LEVEL. A DETAILED SOLAR CELL
EQUIVALENT SERIES RESISTANCE CIRCUIT IS PRESENTED.
STUDIES WERE MADE TO DETERMINE WHERE THE CELL
SERIES RESISTANCE IS LOCATED AND WHICH LOCATIONS ARE
MORE IMPORTANT WITH RESPECT TO THE REDUCTION OF THE
TOTAL SERIES RESISTANCE. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 295 558

RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC
PRODUCTS

SOLAR CELL ARRAY OPTIMIZATION

(U)

DEC 62 IV

UNCLASSIFIED REPORT

DESCRIPTORS: *CRYSTALS, *POWER SUPPLIES, CADMIUM
COMPOUNDS, DESIGN, ELECTRICAL PROPERTIES, ELECTRONS,
FILMS, MANUFACTURING, PHOTOELECTRIC CELLS
(SEMICONDUCTOR), PHOTOELECTRIC MATERIALS, PHOTOTUBES,
PLASTICS, PROTONS, DAMAGE, RADIATION EFFECTS, RESISTANCE
(ELECTRICAL), SEMICONDUCTORS, SOLAR CELLS, SULFIDES,
THIN FILMS (STORAGE DEVICES) (U)
IDENTIFIERS: THIN FILM ELECTRONICS, THIN FILMS (M)

SOLAR CELL ARRAY OPTIMIZATION. RESEARCH AND FABRICATION
PHASES OF THIS WORK WERE DIRECTED TOWARDS DEMONSTRATING
THE POTENTIAL OF LARGE AREA, THIN-FILM CADMIUM SULFIDE
PHOTOVOLTAIC MATERIALS. POWER-TO-WEIGHT RATIO FOR FOUR-INCH
SQUARE CELLS APPROACHES 20 WATTS/LB.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 296 367

RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC
PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE
RADIATION-RESISTANT SOLAR-CELL ARRAY

(U)

JAN 63 IV

UNCLASSIFIED REPORT

DESCRIPTORS: *ELECTRIC POWER PRODUCTION, *SOLAR CELLS,
ARSENIDES, COATINGS, EFFECTIVENESS, ELASTIC PROPERTIES,
ELECTRON IRRADIATION, FAILURE (MECHANICS), GALLIUM
COMPOUNDS, HEAT, INFRARED SPECTROSCOPY, INHIBITION,
LEAD(METAL), LOW TEMPERATURE BATTERIES, OPERATION,
OXIDES, POWER SUPPLIES, DAMAGE, RADIATION EFFECTS,
REFLECTION, SILICON, SILICON COMPOUNDS, SILICONE
PLASTICS, SOLDERED JOINTS, STORAGE, TEMPERATURE, TEST
METHODS (U)

DEVELOPMENT OF HIGH-TEMPERATURE RADIATIONRESISTANT
SOLAR-CELL ARRAY; GALLIUM ARSENIDE AND SILICON CELLS
USED; SILICON MONOXIDE COATINGS WERE TESTED FOR ANTI-
REFLECTION EFFECT; SHELF LIFE OF CELLS AT 200 C WAS
TESTED.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 297 026
SPECTROLAB SYLMAR CALIF

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR
CELLS

(U)

DEC 61 IV FULLER, F.E.;

UNCLASSIFIED REPORT

DESCRIPTORS: *PHOTOELASTICITY, *SOLAR CELLS, DESIGN,
OPTICAL COATINGS, OPTICAL FILTERS, POWER SUPPLIES,
RADIATION EFFECTS, SILICON

(U)

PERFORMANCE ANALYSES OF SILICON CELL SOLAR POWER
SYSTEMS USING RADIATION CONCENTRATION AND FILTERING
HAVE BEEN OBTAINED. PERFORMANCE CHARACTERISTICS OF
SILICON PHOTOVOLTAIC CELLS AND FILTERS HAVE BEEN
STUDIED WITH RESPECT TO THE RELATION OF THEIR
CHARACTERISTICS TO THE POWER SYSTEM DESIGN AND
PERFORMANCE. ELEMENTARY CONDITIONS OF SYSTEM
DESIGN FOR OPTIMUM PERFORMANCE HAVE BEEN
ESTABLISHED. THE ELEMENTS OF PLAN HAVE BEEN
OUTLINED FOR THE DEVELOPMENT OF ADEQUATE METHODS FOR
THE DESIGN AND PERFORMANCE ANALYSIS OF PHOTOVOLTAIC
CELL SOLAR POWER SYSTEMS USING RADIATION
CONCENTRATION AND FILTERING. ALSO, A BASIC PLAN
FOR THE CONSTRUCTION OF A PROTOTYPE SOLAR POWER
SYSTEM WITH CONCENTRATION AND FILTERING HAS BEEN
OUTLINED. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 297 389

LIBRARY OF CONGRESS WASHINGTON D C AEROSPACE TECHNOLOGY
DIV

DIRECT ENERGY CONVERSION IN THE USSR. SOLAR CELL
RESEARCH

(U)

FEB 63 IV
REPT. NO. P 63 20

UNCLASSIFIED REPORT

DESCRIPTORS: *PHOTOELECTRIC MATERIALS, *RESEARCH
MANAGEMENT, CADMIUM COMPOUNDS, COOLING, CRYSTAL DEFECTS,
DIFFUSION, EFFECTIVENESS, ELECTRICAL CONDUCTIVITY, HALL
EFFECT, IMPURITIES, MANUFACTURING, NUCLEAR PARTICLES,
PHOSPHORUS, PHOTOCONDUCTIVITY, SEMICONDUCTING FILMS,
SEMICONDUCTOR DEVICES, SEMICONDUCTORS, SILICON, SOLAR
CELLS, SOLID STATE PHYSICS, SULFIDES, SURFACE
PROPERTIES, TELLURIDES, TEMPERATURE, THEORY (U)

SOLAR CELL RESEARCH AND DIRECT ENERGY CONVERSION IN THE
USSR.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 298 681

ION PHYSICS CORP BURLINGTON MASS

P-N JUNCTION FORMATION TECHNIQUES

(U)

FEB 63 IV KING, WILLIAM J.; BURRILL, JAMES T.;
BUMILLER, DONALD;
CONTRACT: AF33 657 10505

UNCLASSIFIED REPORT

DESCRIPTORS: *ENERGY CONVERSION; *PHOTOELECTRIC CELLS
(SEMICONDUCTOR); CONFIGURATION; COSTS; DIFFUSION;
EFFECTIVENESS; ELECTRIC POTENTIAL; ELECTRON TRANSITIONS;
ION BEAMS; ION BOMBARDMENT; IONS; LIFE EXPECTANCY;
MANUFACTURING; PHOTOELECTRIC EFFECT; PROCESSING;
PRODUCTION; DAMAGE; RADIATION EFFECTS; RELIABILITY;
RESISTANCE (ELECTRICAL); SEMICONDUCTOR DEVICES; SILICON;
SOLAR CELLS; TEMPERATURE
IDENTIFIERS: ION IMPLANTATION

(U)
(M)

FABRICATING SILICON SOLAR CELLS BY ION IMPLANTATION
TECHNIQUES.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 298 759

GENERAL ELECTRIC CO PHILADELPHIA PA MISSILE AND SPACE
DIV

CONFIGURATION STRUCTURE AND SUBSYSTEM ENGINEERING
ANALYSIS REPORT. SECTION 7: ELECTRICAL POWER AND
DISTRIBUTION SUBSYSTEM ENGINEERING ANALYSIS (U)

OCT 62 1V
REPT. NO. 62SD4300 V13
CONTRACT: AFO4 647 476

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER EQUIPMENT, *SOLAR CELLS,
COMMUNICATION SATELLITES (ACTIVE), DISTRIBUTION, POWER
SUPPLIES, DAMAGE, RADIATION EFFECTS, SELECTION, SOLAR
FLARES, TEST VEHICLES, TESTS (U)

ELECTRICAL POWER AND DISTRIBUTION SUBSYSTEMS FOR THE
ADVENT COMMUNICATION SATELLITE. RADIATION EFFECTS ON SOLAR
CELLS. TEST RESULTS AND SELECTION CRITERIA FOR SOLAR
CELLS. PADDLE DEPLOY AND SEPARATION BOLT SQUIB FIRING
TEST.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 400 559

HOFFMAN ELECTRONICS CORP EL MONTE CALIF

SOLAR ENERGY MEASUREMENT TECHNIQUES

(U)

JAN 63 IV ROSS, BERND; BICKLER, D.B.;
CONTRACT: AF33 616 7946
MONITOR: ASD YDR62 882

UNCLASSIFIED REPORT

DESCRIPTORS: *POWER SUPPLIES, *SOLAR CELLS, *SOLAR
RADIATION, CALIBRATION, INSTRUMENTATION, LIGHT,
MANUFACTURING, MEASUREMENT, PYRHELIOMETERS, SILICON,
SPECTRUM ANALYZERS, STABILITY, SUN, TEST EQUIPMENT, TEST
METHODS (U)

IDENTIFIERS: COLOR TEMPERATURE (M)

PORTABLE TEST UNIT TO DETERMINE THE OUTPUT OF A SOLAR
CELL POWER SUPPLY IN SPACE BY ANALYZING OUTPUT UNDER
LABORATORY OR FIELD CONDITIONS.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 400 707

WESTINGHOUSE ELECTRIC CORP DAYTON OHIO

GALLIUM ARSENIDE DENDRITE SINGLE CRYSTAL PROGRAM (U)

FEB 63 IV

CONTRACT: AF33 657 8162

UNCLASSIFIED REPORT

DESCRIPTORS: *GALLIUM COMPOUNDS, *SINGLE CRYSTALS,
*SOLAR CELLS, ARSENIDES, CRYSTAL GROWTH, LABORATORY
FURNACES, MATERIALS, PREPARATION, SHEETS (U)
IDENTIFIERS: DENDRITES(CRYSTALLOGRAPHY) (M)

GROWTH OF GALLIUM ARSENIDE SINGLE CRYSTAL DENDRITES;
SOLAR CELL PREPARATION.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 401 699

HARSHAW CHEMICAL CO CLEVELAND OHIO

LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL ARRAY
INVESTIGATION (U)

MAR 63 IV SCHAEFER, J.C.; WOLFF, G.A.; HILL, E.R.;
CONTRACT: AF33 657 9975

UNCLASSIFIED REPORT

DESCRIPTORS: *CADMIUM COMPOUNDS, *SOLAR CELLS, *THIN
FILMS (STORAGE DEVICES), ACCELERATION, ACRYLIC RESINS,
COATINGS, COPPER, CRYSTAL GROWTH, CRYSTALS,
ELECTRODEPOSITION, EXPERIMENTAL DATA, FILMS, GLASS,
GOLD, LOADING (MECHANICS), MANUFACTURING, MOLYBDENUM,
NICKEL, PLASTICS, SHOCK RESISTANCE, SILVER, SOLAR
PANELS, SONAR SOUND ANALYZERS, SULFIDES, TESTS (U)
IDENTIFIERS: THIN FILMS (M)

LARGE-AREA, THIN-FILM, CADMIUM SULFIDE SOLAR CELL ARRAY
INVESTIGATION.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 401 872
SPECTROLAB SYLMAR CALIF

INVESTIGATION OF OPTICAL COATINGS FOR SOLAR
CELLS

(U)

SEP 62 IV ROMAGNOLI, R.J.:

UNCLASSIFIED REPORT

DESCRIPTORS: *OPTICAL COATINGS, *SOLAR CELLS, *SOLAR
RADIATION, FOCUSING, OPTICAL FILTERS, PHOTOELECTRIC
CELLS (SEMICONDUCTOR), SILICON, SPECTRA (VISIBLE +
ULTRAVIOLET)

(U)

THE CONCENTRATION AND FILTERING OF SOLAR RADIATION WAS
INVESTIGATED IN CONNECTION WITH SILICON PHOTOVOLTAIC
CELLS.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 402 838

TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 2, 15
SEP-15 DEC 62,

DEC 62 1V BERMAN, PAUL A.; HANDY,

RELAND J.; RELIK, GEZA P.;

CONTRACT: DA36 039SC90777

PROJ: DA-3A99-09-002

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON INVESTIGATION FOR THE
IMPROVEMENT OF HIGH EFFICIENCY SILICON SOLAR
CELLS FOR TERRESTRIAL APPLICATIONS.

DESCRIPTORS: *SOLAR CELLS, *SOLAR RADIATION, SOLAR
PANELS, RESISTANCE (ELECTRICAL), COSTS, NITROGEN,
PHOSPHOROUS, IONS, MIRRORS, CIR, SEMICONDUCTOR DEVICES,
EQUATIONS, MATHEMATICAL ANALYSIS, SILICON,
MEASUREMENT.

(U)

THE PURPOSE OF THIS RESEARCH IS THE DEVELOPMENT OF
HIGH EFFICIENCY, LOW COST SILICON SOLAR CELLS. THE
OBJECTIVE IS HIGH YIELDS, IN THE ORDER OF 70% OF
THE CELLS HAVING EFFICIENCIES IN THE RANGE OF 12 TO
14% LEADING TO A CELL COST OF \$2.00 TO \$3.00
FOR A CELL HAVING DIMENSIONS OF 1 CM BY 2 CM. BOTH
N ON P AND P ON N CELL STRUCTURES ARE TO BE
STUDIED AND THE CELLS OPTIMIZED FOR USE IN
TERRESTRIAL ENVIRONMENT WITH AND WITHOUT UTILIZATION
OF SOLAR CONCENTRATORS. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 406 353

WESTINGHOUSE ELECTRIC CORP PITTSBURGH PA

WEBBED DENDRITIC SILICON SOLAR CELL RADIATION
EFFECTS INVESTIGATION.

(U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT., 15 JAN-15

APR 63,

APR 63

36P

TARNEJA, K.S.; BABCOCK, R.V.;

LAMB, R.D.;

REPT. NO. 63 927 534R1

CONTRACT: AF33 657 10527

UNCLASSIFIED REPORT

DESCRIPTORS: *CELLS, RESISTANCE (ELEC, SILICON, DAMAGE,
RADIATION EFFECTS, CRYSTAL, BORON, DIFFUSION,
PHOTOENGRAVING, SPECTROPHOTOMETERS, ELECTRON BEAMS,
RADIATION

(U)

INITIAL WORK TOWARD MAXIMIZING THE RADIATION
RESISTANCE OF SILICON WEBBED DENDRITIC SOLAR CELLS IS
DISCUSSED. DESIGN CONSIDERATIONS, TECHNIQUES FOR
FABRICATING CELLS OF 1 OHM CM RESISTIVITY, AND STEPS
PREPARATORY TO RADIATION DAMAGE STUDY ARE PRESENTED.
EFFICIENCIES AS HIGH AS 12.48 WERE ACHIEVED ON
SOLAR CELLS MADE FROM 1 OHM-CM N-TYPE SILICON WEBBED
DENDRITES. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 407 489

GENERAL INSTRUMENT CORP NEWARK N J

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR
RESEARCH.

(U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 1, 1 MAR-1 JUNE
63.

JUN 63 14P

CONTRACT: AF33 657 10335

PROJ: 8173

TASK: 817302

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR PANELS, *THERMOELECTRICITY,
*GENERATORS, TEST EQUIPMENT (ELECTRONICS), TESTS,
OPTICAL COATING, ELECTRIC POWER PRODUC, SOLAR RADIATION,
SPACECRAFT, FIXED CON, PLASTICS, ALUMINUM, DESIGN,
STRUCTURAL, OPTICAL PROPERTIES, THERMAL RADIATION,
SEMICONDUCTOR, TELLURIUM ALLOYS, BISMUTH ALLOYS, LEAD
ALLOYS, PROCESSING, NICKEL, GOLD, ALUMINUM, REFLECTORS,
HONEYCOMB CORES, SANDWICH CONSTRUC, BONDING,
TEMPERATURE.

(U)

RESEARCH CONCERNS THE DEVELOPMENT OF SOLAR FLAT
PLATE THERMOELECTRIC GENERATORS FOR SPACECRAFT. A
SOLAR FLAT PLATE THERMOELECTRIC GENERATOR CON SISTS
OF A COLLECTOR PLATE WITH AN OPTICALLY SE LECTIVE
COATING, SMALL SIZE SEMICONDUCTOR THERMO ELEMENTS, A
RADIATOR PLATE AND A SUPPORT STRUC TURE. THREE
MONTHS OF RESEARCH AND DEVELOPMENT WORK ON THIS SPACE
AUXILIARY POWER SYSTEM IS DESCRIBED. THE TECHNICAL
PROBLEM AREAS INVESTI GATED INCLUDE: COLLECTOR
COATINGS, THERMOELECTRIC MATERIALS AND CONTACTS AND
SUPPORT STRUCTURES. COLLECTOR COATING SAMPLES
SUITABLE FOR EVALUATION WERE OBTAINED. TEST
EQUIPMENT FOR THERMAL CY CLING TESTS OF SOLAR
THERMOELECTRIC PANELS WAS FABRICATED. PANELS USING
A PLASTIC FO-SUPPORT STRUCTURE AND ON ALUMINUM
HONEYCOMB SUPPORT STRUCTURE WERE FABRICATED AND
TESTED. A NUMBER OF DIFFERENT THERMOELECTRIC
MATERIALS WERE TESTED FOR EFFICIENCY AT VARIOUS
OPERATING TEMPERATURES. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 407 525

HARSHAW CHEMICAL CO CLEVELAND OHIO

LARGE AREA THIN FILM CADMIUM SULFIDE SOLAR CELL
ARRAY INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.
3, 15 MAR-15 JUNE 63,

JUN 63 25P SCHAEFER, J.C.; HUMRICK, R.J.;

HILL, E.R.;

CONTRACT: AF33 657 9975

PROJ: 8173

TASK: 817301

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *X-RAY DIFFRACTION, CRYSTALS,
CADMIUM, SULFIDES, PHOTO, X RAY PHOTOGRAPHY, PURIFI,
DISTILLATION, SEMICONDUCTING FILMS, SULFUR, DIODES
(SEMICONDUCTOR), LUMINESCENCE, CADMIUM COMPOUNDS,
MICROSCOPY. (U)

IDENTIFIERS: THIN FILM ELECTRONICS, THIN FILMS (U)

A 5.18 THIN-FILM CELL WAS PRODUCED ON A 1 IN. X
1 IN. SUBSTRATE. THIS RESULT COMPARES FAVORABLY
WITH THE MAXIMUM EFFICIENCY OF 5.48 REPORTED FOR A
SINGLE CRYSTAL CDS CELL. A PROCEDURE FOR UP
GRADING LOW EFFICIENCY CELLS TO THE AVERAGE
EFFICIENCY LEVEL WAS ALSO DEVELOPED. A NON
DESTRUCTIVE X-RAY TECHNIQUE WAS USED SUCCESSFULLY TO
PHOTOGRAPH DISLOCATIONS IN SINGLE CRYSTAL CDS.
THIS PROCEDURE PROMISES TO YIELD A FUND OF
INFORMATION. EFFORTS TO PRODUCE AN ULTRAPURE
CDS BY DISTILLATION OF THE ELEMENTS AND
SUBSEQUENT REACTION IS UNDERWAY. WORK WAS CARRIED
ON IN THE ANALYSIS OF THE I-V DATA AND SPECTRAL
RESPONSE IN AN EFFORT TO CATALOG THIS DATA IN THE
FORM OF A. THE PRESENT DATA CAN BE IN AN EFFORT TO
CATALOG THIS DATA IN THE FORM OF A MODEL. THE
PRESENT DATA CAN BE MADE TO FIT A P-N JUNCTION WITH
PHOTOCONDUCTIVE SERIES AND SHUNT RESISTANCES. SOME
REJECT 'SHORTED' CELLS WERE STUDIED AT LOW
TEMPERATURES WHERE THE I-V CURVE BEGINS TO
RESEMBLE A BACKWARD DIODE. INJECTION LUMINESCENCE
WITH VERY LOW CONVERSION EFFICIENCY WAS OBSERVED WITH
THE RADIATION LYING IN THE BAND BETWEEN 1 AND 1.5 EV.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 409 001

TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 3, 15 DEC
62 15 MAR 63,

APR 63 IV BERMAN, PAUL A.; HANDY,

ROLAND J.; ROLIK, GEZA P.;

CONTRACT: DA36 039SC90777

PROJ: 3A99 09 002

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, ELECTRICAL PROP), (*SOLAR
RADIATION, INTENSITY), RESIST, SILICON, DESIGN, THEORY,
MEASUREMENT, ELECTRIC CURRENTS, MIRRORS, ELEC,
MATHEMATICAL PREDICTION, EQUATIONS. (U)

AN ADDITIONAL MIRROR WAS ADDED TO THE SOLAR CON
CENTRATOR EQUIPMENT SO THAT IT IS POSSIBLE TO MAKE
SOLAR CELL MEASUREMENTS AT APPROXIMATELY 5 GM-
CALORIES/SQ CM/MIN SOLAR INTENSITY. THE
CONCENTRATOR WAS USED TO VERIFY THE SUNLIGHT POWER
PREDICTIONS MADE FROM TUNGSTEN POWER MEASUREMENTS
DURING THE P(I)/N BIVARIABLE EXPERIMENT. A
GENERAL EQUATION WAS DEVELOPED FOR THE THEORETICAL
DETERMINATION OF THE TOTAL CELL SERIES RESISTANCE
FROM A KNOWLEDGE OF THE VALUES OF THE COMPONENT
RESISTANCES. THE EQUATIONS WERE UTILIZED TO
PREDICT THE SERIES RESISTANCE OF PRODUCTION TYPE
N(I)/P AND N(I)/N CELLS. (AUTHOR) (U)

DEF A-100-100-100

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 411 257

RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC
PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH TEMPERATURE
RADIATION RESISTANT SOLAR CELL ARRAY, VOLUME 1. (U)

DESCRIPTIVE NOTE: ANNUAL REPT., 15 APR 62-14 APR 63.

JUN 63 94P

CONTRACT: AF33 657 8490

PROJ: 8173

TASK: TASK 817301 16

MONITOR: ASD TDR63 516, VI

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: REPORT ON STATIC ENERGY
CONVERSION TECHNOLOGY.

DESCRIPTORS: (*SOLAR CELLS, HIGH-TEMPERATURE), GALLIUM
COMPOUNDS, ARSENIDES, GAL, ARSENIC ALLOYS, AEROSPACE
CRAFT, DESIGN, SINGLE CRYSTALS, MANUFACTURING, FILMS,
TESTS, RADIATION DAMAGE. (U)
IDENTIFIERS: THIN FILMS (U)

A TOTAL OF 780 CELLS WAS PRODUCED WITH EFFICIEN
CIES OF UP TO 10% AND WITH A MODE EFFECIENCY OF
EIGHT PERCENT FOR THE LATER UNITS. TESTS OF THE
CELLS MADE AT ELEVATED TEMPERATURES AND IN HIGH
RADIATION ENVIRONMENTS HAVE ESTABLISHED THE
CHARACTERISTICS OF THE CELLS. THE CRITICAL FLUX
FOR THE GALLIUM ARSENIDE CELLS EQUALLED OR EX CEDED
THAT OF SILICON CELLS. TESTS OF CADMIUM SULFIDE
CELLS WERE NOT JUDGED SUFFICIENTLY CON CLUSIVE TO
ESTABLISH THE LEVEL OF CRITICAL FLUX. SOLDERING
TECHNIQUES WERE DEVELOPED AND EVALUATED IN TERMS OF
THE EFFECTS UPON FINISHED CELLS. THERMAL
CHARACTERISTICS OF THE CELLS AND PANELS WERE
APPRAISED IN TERMS OF ORBITAL EVALUATION. PANEL
ASSEMBLY TECHNIQUES WERE DEVELOPED AND EVALUATED IN
TERMS OF THE ELECTRICAL AND MECHANICAL
CONSIDERATIONS INVOLVED IN INTEGRATING CELLS INTO
PANELS. INVESTIGATION AND FABRICATION OF SINGLE-
CRYSTAL, THIN-FILM GALLIUM ARSENIDE CELLS WERE MADE.
EVALUATION OF METHODS FOR DEPOSITING EPITAXIAL
FILMS, TECHNIQUES FOR PRODUCING THE DESIRED
"DOPING" STRUCTURE, AND STUDIES OF THE RESULTANT
PHOTOVOLTAIC AND SURFACE-CONTACTING PROPERTIES WERE
MADE FOR THIN-FILM GAAS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 412 654

RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC
PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH-TEMPERATURE RAD
IATION-RESISTANT SOLAR-CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.
4, MAY JUL 63.

JUL 63 23P

REPT. NO. AED R2043

CONTRACT: AF33 657 8490

TASK: TASK 817301 16

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), (*ADHESIVES,
SOLAR CELLS), GALLIUM, ARSENIC ALLOYS, HONEYCOMB CORES,
ALUMI, TESTS, TEMPERATURE, VACUUM, MECHANICAL,
THICKNESS, SEMICONDUCTING FILMS, DIFFUSION, EPITAXIAL
GROWTH, IMPURITIES, ZINC, CHEMICAL MILLING,
TABLES(DATA), EQUATIONS, MEASURE, METAL COATINGS,
RADIATION DAMAGE. (U)

IDENTIFIERS: *THIN FILMS (U)

CONTENTS: GALLIUM ARSENIDE CELL DEVELOPMENT AND
FABRICATION; ARRAY DESIGN AND TESTING; SUMMARY,
ARRAY DESIGN, MODULE DESIGN, FIXTURE DESIGN,
MATERIALS TEST AND SELECTION, PROTOTYPE PANEL,
RADIATION TESTING; THIN-FILM GALLIUM ARSENIDE
INVESTIGATION, THIN FILM DIFFUSED-JUNCTION SOLAR
CELLS, THIN-FILM GROWN-JUNCTION SOLAR CELLS,
PROPERTIES OF EVAPORATED METALLIC CONTACTS ON
GAAS, ANALYSIS, MEASUREMENTS. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 418 154

HAMILTON STANDARD WINDSOR LOCKS CONN

MODULAR DESIGN OF IMPROVED SOLAR CONVERTERS.

(U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 7, 1 DEC
62 28 FEB 63,

FEB 63 1V

MORIARTY, WILLIAM J.;

REPT. NO. HSER2667

CONTRACT: DA36 D39SC87461

PROJ: DA PROJ. 1G622001A053 03

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, MODULES (ELEC), (*SOLAR
CELLS, MANUFACTURING), SILICON, MOLDINGS, BONDING,
ELECTRIC CURRENTS, ELECTRIC POTENTIAL, PLASTICS, ACRYLIC
RESINS. (U)

THREE IMPORTANT TESTS WERE CONDUCTED DURING THIS
PERIOD: (1) A TEMPERATURE GRADIENT TEST OF THE
PROTOTYPE MODULE; (2) A MOLDED SHINGLE ASSEMBLY
SHEAR TEST; AND (3) A CURRENT VERSUS VOLTAGE OUT
PUT OF THE ACTIVE MODULE. RELATIVE TO THE
SPECIAL WARFARE CONCEPTUAL DESIGN, DRAWINGS OF A
MARKEDLY DIFFERENT MORE ADVANCED ARRAY WERE
COMPLETED. USAELRDL SUGGESTED THAT DETAILED
SKETCHES OF THIS CONCEPT BE DEVELOPED FOR FURTHER
EVALUATION. A WIRING LAYOUT AND CALCULATIONS FOR
THE ELECTRICAL DESIGN OF THE ACTIVE 5-WATT MODULE
WERE DEVELOPED WHICH INDICATE THE NUMBER OF CELLS
PER SERIES STRING, TOTAL NUMBER OF CELLS, ELECTRICAL
OUTPUT, AND PHYSICAL SIZE. LIGHT TRANSMISSION
TESTS WERE PERFORMED ON THE MATERIALS LISTED IN THE
PREVIOUS REPORT WHICH WERE SUBJECTED TO ULTRA-VIOLET
AND SUNLIGHT EXPOSURE. AN EVALUATION OF THE ADDI
TIONAL COVER MATERIALS ALSO LISTED IN THE SAME
REPORT HAS BEEN MADE BASED ON LIGHT TRANSMISSION
LOSSESS AND LITERATURE ANALYSIS. (AUTHOR) (U)

BEST AVAILABLE COPY

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 418 322

GENERAL INSTRUMENT CORP NEWARK N J

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR
RESEARCH. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 2, 1 JUNE-1 SEP
63.

SEP 63 24P

CONTRACT: AF33 657 10335

PROJ: 8173

TASK: 817302

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, THERMOELECTRIC),
(*AUXILIARY POWER PLANTS, SPACECRAFT), DESIGN, OPTICAL
COATINGS, TEMPERATURE, STRUC, THERMOCOUPLES, ENERGY
CONVERSION, SOLAR RADIATION, METAL PLATES, PIPES,
ALUMINUM, NICKEL, THICKNESS, WEIGHT, SOLDERED JOINTS,
TESTS. (U)

A SOLAR FLAT PLATE THERMOELECTRIC GENERATOR CON
SISTS OF A COLLECTOR PLATE WITH AN OPTICALLY
SELECTIVE COATING, SMALL SIZE SEMICONDUCTOR
THERMOELEMENTS, A RADIATOR PLATE AND A SUPPORT
STRUCTURE. EMPHASIS HAS BEEN PLACED ON A SUPPORT
STRUCTURE CONCEPT DESIGNATED AS THE INTEGRAL
REINFORCED PLATE IN WHICH RADIATOR AND COLLECTOR
PLATES ARE FOLDED INTO SELF-SUPPORTING STRUCTURES.
A NUMBER OF THERMAL CYCLING TESTS HAVE BEEN CON
DUCTED UP TO A MAXIMUM OF 2000 CYCLES. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 421 700

GENERAL ELECTRIC CO AUBURN N Y

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR
CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.
4, 1 JULY-30 SEP 63.

SEP 63 31P

CONTRACT: AF33 657 10601

TASK: 817301 33

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SEMICONDUCTING FILMS),
(*SEMICONDUCTING FILMS, SOLAR CELLS), CADMIUM ALLOYS,
TELLURIUM ALLOYS, CRYSTAL GROWTH, FEASIBILITY STUDIES,
SURFACES, SOLDERING, MAINTENANCE, COPPER ALLOYS (U)
IDENTIFIERS: THIN FILMS (U)

THE EMPHASIS OF THE THIN FILM SOLAR CELL WORK WAS
ON (1) GROWING ACCEPTABLE CADMIUM TELLURIDE FILMS
IN VERTICAL SUBSTRATES TO YIELD MORE USABLE AREA,
(2) FABRICATING CELLS THAT HAVE JUNCTION AREAS OF
40 TO 50 SQ CM, (3) EXPERIMENTING WITH DIFFERENT
SURFACE TREATMENTS TO YIELD MORE UNIFORM CELLS,
(4) INVESTIGATING METHODS OF ATTACHING LEADS TO
THE CELLS (INDIUM SOLDERING SEEMS SATISFACTORY),
(5) TAKING DATA ON FOUR-MONTH OLD CELLS TO SEE
HOW THE CELLS PARAMETER CHANGE WITH TIME, AND (6)
PERFORMING BASIC STUDIES OF THE PROPERTIES OF
JUNCTIONS BETWEEN CDTE AND OTHER MATERIALS.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 422 396

GOODYEAR AEROSPACE CORP AKRON OHIO

SOLAR ORIENTING DEVICE FOR EXPANDABLE FLAT-PANEL
ARRAY.

(U)

DESCRIPTIVE NOTE: FINAL REPT. FOR 1 JULY 61-30 JUNE
63.

JUL 63 100P MCKEEL, G. J. ;

REPT. NO. GER-11184

CONTRACT: DA-36-039-SC-88913

PROJ: DA-1-G-622001-A-053

TASK: 1-G-622001-A-053-03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, POSITIONING DEVICES),
(*SOLAR PANELS, POSITIONING DEVICES), SOLAR RADIATION,
CIRCUITS, EXPERIMENTAL DATA, PHOTOELECTRIC CELLS, WIND,
SUN, ELECTRIC, ELECTRIC POTENTIAL (U)

THIS REPORT SUMMARIZES THE RESULTS OF TWO YEARS OF
ANALYTICAL STUDIES AND EXPERIMENTAL TESTING OF
SYSTEMS FOR AUTOMATICALLY ORIENTING VARIOUS SIZED
SOLAR CELL PANELS CONTINUOUSLY TO THE SUN. ANALYSIS
OF THE APPARENT MOTION OF THE SUN, WIND EFFECTS,
PANEL ORIENTATION, SUN SENSING, AND BASIC SYSTEM
CONFIGURATIONS ARE INCLUDED IN THE SECTION ON GENERAL
STUDIES. A SECTION IS PRESENTED ON THE OPERATION,
DESIGN, AND FABRICATION OF THE SINGLE-AND TWO-AXIS
SUN SENSORS. SYSTEM CIRCUIT DIAGRAMS ARE INCLUDED
FOR BOTH THE SINGLE-AXIS AND TWO-AXIS AUTOMATIC DRIVE
SYSTEMS. DESCRIPTIONS OF THE MOUNT AND DRIVE HEAD
ASSEMBLIES ARE INCLUDED, AND THE GENERAL SETUP
CONSIDERATION FOR EACH SYSTEM IS GIVEN. ADVANTAGE
OF THE TWO-AXIS AUTOMATIC SYSTEM OVER THE SINGLE-AXIS
AUTOMATIC SYSTEM IS ALSO PRESENTED. EXPERIMENTAL
RESULTS ON THE SINGLE-AXIS SUN SENSOR AND ITS
ASSOCIATED DRIVE SYSTEM ARE GIVEN. THE
EXPERIMENTAL TESTING ON THE TWO-AXIS SUN SENSOR AND
THE COMPLETE TWO-AXIS SYSTEM IS INCLUDED.
EXPERIMENTAL RESULTS SHOW THE EVOLUTION FROM THE
SIMPLE AUTOMATIC SINGLE-AXIS SENSOR WITH AN ACCURACY
OF 10 DEGREES TO THE COMPLETELY AUTOMATIC TWO-AXIS
SYSTEM WITH POINTING ERROR OF LESS THAN 1 DEGREE.
CONCLUSIONS AND RECOMMENDATIONS ARE PROVIDED TO
INDICATE THE ADVANTAGES AND POSSIBLE DIRECTION THESE
ORIENTING SYSTEMS MAY TAKE IN THEIR APPLICATION TO
GROUND POWER DEVICES. (AUTHOR) (U)

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UNCLASSIFIED

/ZOM07

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 422 529

TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 4, 15

MAR-15 JUNE 63,

JUL 63 1V BERNAN, PAUL A. ;

CONTRACT: DA36 039SC90777

PROJ: AGC22001A053 03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SILICON, SOLAR CELLS), MANUFACTURING, COSTS, PRODUCTION, PERFORMANCE (ENGINEERING), ELECTRIC POTENTIAL (U)

FIVE HUNDRED P(+)/N AND FIVE HUNDRED N(+)/P CELLS HAVE BEEN FABRICATED ON A PILOT LINE BASIS. THERE WAS A 70% YIELD OF P(+)/N CELLS HAVING A 100 MW/SQ CM SUNLIGHT EFFICIENCY OF 11.4% OR GREATER. THERE WAS A 70% YIELD OF N(+)/P CELLS HAVING A 100 MW/SQ CM SUNLIGHT EFFICIENCY OF 10.1% OR GREATER. PRELIMINARY MEASUREMENTS INDICATE A SUBSTANTIAL INCREASE IN EFFICIENCY FOR BOTH CELL TYPES AT SOLAR INTENSITIES OF APPROXIMATELY 300 MW/SQ CM, DUE TO THE SPECIFIC DESIGN OF THESE CELLS FOR OPERATION AT THESE INTENSITIES, THUS SHOWING GOOD PERFORMANCE FOR OPERATION IN SYSTEMS UTILIZING SOLAR CONCENTRATORS. COMPARISONS ARE MADE BETWEEN THE PILOT LINE N(+)/P AND P(+)/N CELLS; AND BETWEEN THESE CELLS AND COMMERCIALY AVAILABLE PRODUCTION CELLS OF BOTH POLARITIES. COST ESTIMATES ARE GIVEN ON THE BASIS OF THE YIELDS OBTAINED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 423 684
HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR
CELLS. (U)

DESCRIPTIVE NOTE: REPT. FOR SEP 62-NOV 63,
NOV 63 60P SCHAEFER, J. C. HUMRICK, R. J.
HILL, E. R. BELT, R. F. :
CONTRACT: AF33 657 9975
PROJ: 8173
TASK: 817301 32
MONITOR: ASD TDR63 743

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, CADMIUM COMPOUNDS),
(*SEMICONDUCTING FILMS, CADMIUM COMPOUNDS), (*CADMIUM
COMPOUNDS, SULFIDES), PHOTOELECTRIC CELLS
(SEMICONDUCTOR), DESIGN, MATERIALS, ELECTRODES, LIFE
EXPECTANCY, DAMAGE, RADIATION EFFECTS, ELECTRONS,
CRYSTAL DEFECTS, STABILITY, MANUFACTURING, CRYSTAL
GROWTH, ENCAPSULATION, SANDWICH CONSTRUCTION, PLASTICS,
PHOTONS, ENERGY, ELECTRICAL PROPERTIES, SPACECRAFT (U)
IDENTIFIERS: QUANTUM YIELD, THIN FILMS (U)

RESEARCH AND DEVELOPMENT OF A LARGE AREA CDS,
VACUUM EVAPORATED, THIN FILM, FLEXIBLE, LIGHTWEIGHT,
FRONT WALL SOLAR CELL WAS CONTINUED IN AN EFFORT TO
IMPROVE THE PERFORMANCE CHARACTERISTICS.
EFFICIENCIES WERE INCREASED TO A MAXIMUM OF 5.1%.
POWER TO WEIGHT RATIOS OF 15 WATTS PER POUND ARE
NORMAL WITH 30 AS A MAXIMUM. AN UPGRADING PROCEDURE
FOR LOW EFFICIENCY CELLS WAS DEVELOPED. TEST PANELS
WERE SUBMITTED FOR A 30 DAY ORBITAL SPACE FLIGHT
EVALUATION. ELECTRON DAMAGE EXPERIMENTS INDICATE
LITTLE EFFECT ON THE CDS SOLAR CELLS. X-RAY
TECHNIQUES HAVE BEEN USED TO PHOTOGRAPH DISLOCATIONS
IN SINGLE CRYSTAL CDS. CURRENT-VOLTAGE CURVES
AND SPECTRAL RESPONSE DATA ANALYSES RESULTED IN A
ONE-TRAP MODEL OF THE CDS PHOTOVOLTAIC CELL.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 427 070

MALLORY (P R) AND CO INC BURLINGTON MASS

CELL EQUALIZATION TECHNIQUES.

(U)

DESCRIPTIVE NOTE: FINAL REPT.,

DEC 63 28P WHORISKEY, PETER J. ;

CONTRACT: AF33 657 8749

PROJ: 8173

TASK: 817304 18

MONITOR: RTD TDR63 4187

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, STORAGE BATTERIES),
(*STORAGE BATTERIES, SOLAR CELLS), (*ALKALINE BATTERIES,
SOLAR CELLS), NICKEL, CADMIUM, DIODES (SEMICONDUCTOR),
GERMANIUM, LIFE EXPECTANCY, SILICON, SILVER, ZINC,
ELECTRIC DISCHARGES, BATTERIES AND COMPONENTS (U)

A SPACE VEHICLE POWER SUPPLY CONSISTS OF CERTAIN TYPES OF HERMETICALLY SEALED ALKALINE BATTERY CELLS COUPLED WITH SOLAR CELLS. DURING USAGE THESE ALKALINE BATTERY CELLS, SERIES CONNECTED, ARE REPEATEDLY SUBJECTED TO CHARGE-DISCHARGE CYCLES THAT CAN PRODUCE CELL FAILURE. THESE FAILURES ARE, IN TURN, ATTRIBUTABLE TO INHERENT CELL DIFFERENCES INTENSIFIED BY CYCLING RATE, OVERALL CYCLING TIME AND DEPTH OF DISCHARGE. THE PRIME FAILURE MODES CONSIST OF: (A) UNEQUAL CELL CHARGE WHICH CAUSES THE EVOLUTION OF GAS IN SUFFICIENT QUANTITIES TO DESTROY THE CELL, AND (B) CELL REVERSAL ON DISCHARGE THAT EFFECTIVELY CANCELS THE CELL FROM THE CIRCUIT AND ULTIMATELY RESULTS IN CELL FAILURE. THE OBJECTIVES OF THIS PROGRAM WERE, ACCORDINGLY, TO INVESTIGATE: (1) METHODS OF EQUALIZING THE TERMINAL VOLTAGE OF THE INDIVIDUAL CELLS ON CHARGE, AND (2) METHODS OF PREVENTING CELL REVERSAL UPON DISCHARGE. TO ACHIEVE CELL EQUALIZATION, THE LOGARITHMIC FORWARD VOLT-AMPERE CHARACTERISTIC OF SEMICONDUCTOR P-N JUNCTIONS WAS INVESTIGATED IN DEPTH. SEMICONDUCTOR DIODES WERE DESIGNED AND TESTED FOR SPECIFIC V-I SLOPES AND CURRENT HANDLING CAPABILITY. SIMILARLY, THE ANTI-REVERSAL APPROACH CONSISTED OF UTILIZING THE LOW FORWARD DROP OF ESPECIALLY FABRICATED GE DIODES WHICH WERE PLACED ACROSS THE CELL TERMINALS, IN PARALLEL TO, BUT IN POLARITY OPPOSING THE EQUALIZER DIODES. THESE DIODE ASSEMBLIES MATERIALLY INCREASED THE CYCLE LIFE OF NI-CD CELLS.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 427 608

GENERAL ELECTRIC CO AUBURN N Y

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR
CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.
5, 1 OCT-31 DEC 63.

DEC 63 35P

CONTRACT: AF33 657 10601

TASK: 817301 33

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, VAPOR PLATING), (*CADMIUM
ALLOYS, TELLURIUM ALLOYS), (*CRYSTAL STRUCTURE, SOLAR
CELLS), MOLYBDENUM, COPPER, TELLURIUM, CADMIUM, NICKEL,
GOLD, IMPURITIES, GALLIUM, ELECTRODES, ALUMINUM, SILVER,
CHROMIUM, BERYLLIUM, BISMUTH, ANTIMONY, LEAD(METAL),
DIODES, ELECTRICAL CONDUCTIVITY, ELECTRIC POTENTIAL,
EFFECTIVENESS, REFLECTORS, INDIUM COMPOUNDS, OXIDES (U)
IDENTIFIERS: HETEROJUNCTIONS, INDIUM(III) OXIDE, THIN
FILMS (U)

STUDIES OF FACTORS AFFECTING THE PROPERTIES OF
POLYCRYSTALLINE CDE FILM GROWN BY THE VAPOR
REACTION PROCESS ARE DISCUSSED AND A VARIETY OF
MOLYBDENUM SUBSTRATES ARE COMPARED. NO REAL
DIFFERENCES ARE FOUND. ROUGH MEASURES OF
TEMPERATURE EFFECTS AND TELLURIUM FLOW RATE ON FILM
GROWTH RATE ARE REPORTED. THE TAILORING PROCESS WAS
CHANGED IN TWO RUNS WITH EFFICIENCY MARKEDLY
IMPROVED. THE PRINCIPAL CONCLUSION OF A STUDY OF
EVAPORATED METAL CONTACTS IS THAT GOLD IS THE BEST
ELECTRODE MATERIAL OF THE TEN EXAMINED. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 428 424

ION PHYSICS CORP BURLINGTON MASS

P-N JUNCTION FORMATION TECHNIQUES.

(U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.
1, 2 OCT 63-2 JAN 64.

JAN 64 66P

CONTRACT: AF33 615 1097

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SEMICONDUCTING
FILMS, VAPOR PLATING), SINGLE CRYSTALS, VACUUM
APPARATUS, PLASMA MEDIUM, TANTALUM, GLASS, PHOSPHORUS,
IONS, RESISTANCE (ELECTRICAL), PRODUCTION,
MANUFACTURING, TRACER STUDIES

(U)

IDENTIFIERS: PN JUNCTIONS, PYREX

(U)

AN APPLIED RESEARCH PROGRAM HAS BEEN INITIATED TO INCREASE THE STATE-OF-THE-ART EFFICIENCY OF SOLAR CELLS PRODUCED BY ION IMPLANTATION TECHNIQUES AND TO DEMONSTRATE FEASIBILITY FOR PRODUCING THIN FILM SOLAR CELLS BY PLASMA DEPOSITION. DURING THIS QUARTER, EFFORTS IN THE ION IMPLANTATION AREA PRIMARILY HAVE INVOLVED FOUNDATION INVESTIGATIONS AND EQUIPMENT MODIFICATIONS. PREVIOUS INVESTIGATIONS HAD POINTED OUT THREE MAJOR PROBLEM AREAS IN ION IMPLANTATION CELLS: MATERIAL PROBLEMS, RESISTIVITY PROBLEMS, AND OTHER PROBLEMS RESULTING FROM IMPLANTATION TECHNIQUES. THE LATTER, IN PARTICULAR, INVOLVED FORWARD LEAKAGE EFFECTS WHICH WERE MASKING THE EFFECTS ON CELL PERFORMANCE OF OTHER VARIABLES SUCH AS JUNCTION PROFILE VARIATIONS. A MAJOR EFFORT WAS MADE TO DETERMINE THE REASONS FOR THIS LEAKAGE AND RESULTS UNEQUIVOCALLY INDICATE THE SOURCE TO BE PIPES CAUSED BY DIRT-SHADOWING DURING IMPLANTATION. AN EXTENSIVE INVESTIGATION WAS INITIATED INTO AN EXACT MEASUREMENT OF THE ACTUAL JUNCTION PROFILES PRESENT AS A FUNCTION OF IMPLANTATION PARAMETERS AND ANNEALING PROCEDURES. THIS INVOLVES A DETERMINATION OF THE RATIO OF ELECTRICALLY ACTIVE TO PHYSICALLY PRESENT PHOSPHOROUS BY RESISTIVITY AND TRACER TECHNIQUES. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 428 634

RADIO CORP OF AMERICA PRINCETON N J DEFENSE ELECTRONIC
PRODUCTS

APPLIED RESEARCH PROGRAM ON HIGH TEMPERATURE
RADIATION RESISTANT SOLAR CELL ARRAY, VOLUME 11. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT., 15 APR-15 OCT 63.

DEC 63 57P

CONTRACT: AF33 657 8490

PROJ: 8173

TASK: 817301 16

MONITOR: ASD TOR63 516, VOL. 2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, HIGH TEMPERATURE), (*HIGH
TEMPERATURE, DAMAGE), (*DAMAGE, SOLAR CELLS),
CONFIGURATION, AEROSPACE CRAFT, GALLIUM COMPOUNDS,
ARSENIDES, CADMIUM COMPOUNDS, SULFIDES, THIN FILMS
(STORAGE DEVICES), (U)THIN FILMS (STORAGE DEVICES) (U)
IDENTIFIERS: THIN FILM ELECTRONICS, THIN FILMS (U)

RESEARCH FOR DEVELOPMENT OF A HIGH-TEMPERATURE, RADIATION
RESISTANT, SOLAR CELL ARRAY FOR AEROSPACE VEHICLE.

UNCLASSIFIED

DNC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 428 999

TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 5, 15
JUNE-15 SEP 63.

OCT 63 1V BERMAN, PAUL A. ;

CONTRACT: DA36 0395C90777

PROJ: 16C22001A053 03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SILICON, SOLAR CELLS), (*ENERGY CONVERSION, SOLAR CELLS), CRYSTALS, DIFFUSION, DESIGN, COATINGS, SILICON COMPOUNDS, OXIDES, RESISTANCE (ELECTRICAL), COSTS, STATISTICAL ANALYSIS (U)

SOME ADDITIONAL STATISTICAL ANALYSES OF THE FIRST N(+)-P BIVARIABLE EXPERIMENT WERE MADE. THE VARIANCE ON THIS EXPERIMENT WAS GREATER FROM RUN TO RUN THAN WITHIN A RUN, AT ANY GIVEN DESIGN POINT. A PRELIMINARY STATISTICAL EXPERIMENT WAS PERFORMED ON N(+)-P CELLS HAVING BETWEEN 5 AND 27 GRID LINES WITH DIFFUSION TIMES OF 20 AND 80 MINUTES. HALF THE CELLS WERE COATED WITH SiO WHILE HALF WERE NOT. EXPERIMENTAL RESULTS SHOWED A FLAT OPTIMUM BETWEEN 9 AND 18 GRID LINES, AND BETWEEN THE DIFFUSION TIMES OF 20 AND 80 MIN. WITH REGARD TO THE LATTER VARIABLE, THE RELATIVE INSENSITIVITY OF N(+)-P CELL EFFICIENCIES, AS COMPARED TO P(+)-N CELL EFFICIENCIES, WITH VARIATION OF JUNCTION DEPTH WAS AGAIN OBSERVED, AND THIS INSENSITIVITY CAUSED SOME DIFFICULTY IN DETERMINING A CLEAR SUPERIORITY OF ONE DIFFUSION TIME OVER THE OTHER DUE TO THE MASKING EFFECTS OF OTHER VARIABLES. CELLS HAVING TOTAL CELL SERIES RESISTANCES OF LESS THAN 0.20 OHMS WERE FABRICATED. POLYCRYSTALLINE CELLS SHOWED SUNLIGHT CONVERSION EFFICIENCIES OF AS HIGH AS 11%.

(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 429 136

WESTINGHOUSE ELECTRIC CORP DAYTON OHIO

DENDRITIC SILICON SOLAR CELL PANEL.

(U)

DESCRIPTIVE NOTE: FINAL REPT., AUG 62-AUG 63,
OCT 63 80P TARNEJA, K. S. ; ROSSI, V. A. ;
CONTRACT: AF33 657 9820
PROJ: 8173
TASK: 817301 29
MONITOR: RTD TOR63 40 30

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), (*SOLAR
PANELS, SILICON), (*SILICON, SOLAR CELLS), THERMAL
EXPANSION, ACCELERATION, VIBRATION, SHOCK (MECHANICS),
PHYSICAL PROPERTIES, ENERGY CONVERSION, DIFFUSION,
OPTICAL PROPERTIES, LIFE EXPECTANCY, DESIGN, TESTS, TEST
EQUIPMENT

(U)

IDENTIFIERS: DENDRITES (CRYSTALLOGRAPHY)

(U)

STUDIES DIRECTED TOWARD THE FABRICATION OF HIGH
EFFICIENCY SOLAR CELLS ON SILICON WEBBED DENDRITES
AND THE SOLAR CELL PANELS WERE UNDERTAKEN. SOME OF
THE BASIC DESIGN CONSIDERATIONS AND FABRICATION
TECHNIQUES ARE PRESENTED. PREPARATION OF P(+)N
AND N(+)P SOLAR CELL STRUCTURE IS DISCUSSED.
CELL EFFICIENCIES WERE MEASURED USING TWO TUNGSTEN
PHOTOFLOOD LAMPS AS THE LIGHT SOURCE.
EFFICIENCIES AS HIGH AS 13% WERE ACHIEVED ON 2CM
X 1CM X 0.05CM, AS HIGH AS 12% WERE ACHIEVED ON
15CM X 1CM X 0.05CM, AND AS HIGH AS 10% WERE
ACHIEVED ON 30CM X 1CM X 0.05CM SOLAR CELLS PREPARED
FROM SILICON WEBBED DENDRITES. SPECTRAL RESPONSE
MEASUREMENTS WERE MADE ON SILICON WEB SOLAR CELLS AND
TYPICAL CURVES ARE PRESENTED. ONE MECHANICAL
SAMPLE, FOUR OPERATIONAL SOLAR CELL PANELS, AND TWO
SPECIAL OPERATIONAL PANELS WERE FABRICATED, TESTED
AND SUBMITTED IN PART FULFILLMENT OF THE SUBJECT
CONTRACT. COMPLETE RESULTS ON THESE PANELS ARE
DISCUSSED. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 432 192

HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.

1, 25 NOV 63-25 FEB 64,

MAR 64 SSP

SCHAEFER, J. C. ; HUMRICK, R. J.

IBELT, R. F. ;

CONTRACT: AF33 615 1248

TASK: 817301 32

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS, SULFIDES), VAPOR PLATING, VACUUM APPARATUS, QUARTZ, TANTALUM, SILICON, FLUORIDES, COPPER COMPOUNDS, CALCIUM COMPOUNDS, TITANIUM, NICKEL ALLOYS, IRON ALLOYS, ELECTROPLATING, PH FACTOR, COPPER, SULFUR, ZIRCONIUM, MOLYBDENUM, TUNGSTEN, HEAT TREATMENT, OPTICAL PROPERTIES, ELECTROPLATING, SOLUTIONS(MIXTURES) (U)
IDENTIFIERS: COPPER(I) SULFIDE (U)

THE PURPOSE OF THIS PROGRAM IS TO CONTINUE THE RESEARCH AND DEVELOPMENT ON LARGE AREA, THIN FILM FLEXIBLE, LIGHT WEIGHT CADMIUM SULFIDE SOLAR CELLS. HIGHER EFFICIENCY STABLE CELLS WITH A HIGH POWER TO WEIGHT RATIO ARE GOALS OF THIS PROGRAM. HIGHER EFFICIENCY CELLS APPEAR PROBABLE WHEN THE BARRIER IS FORMED CHEMICALLY. CELLS HAVE BEEN FABRICATED FOR EXPOSURE TO GAMMA RADIATION AT NEL. NEW CONTACTING TECHNIQUES ARE BEING INVESTIGATED FOR APPLICATION ON THE ONE SQUARE FOOT AND ONE-HALF SQUARE FOOT ARRAYS. A REAR WALL THIN FILM CDS PHOTOVOLTAIC CELL CAN BE PRODUCED. A CONSIDERABLE EFFORT WOULD BE NEEDED TO PERFECT THIS INTO AN EFFICIENT AND USABLE ITEM. FURTHER WORK HAS BEEN ABANDONED. THE PRINCIPAL VACUUM EVAPORATION PARAMETERS OF SUBSTRATE TEMPERATURE AND SURFACE PERFECTION HAVE BEEN STUDIED FOR CDS DEPOSITIONS. THIN FILMS OF CDS WERE PREPARED ON MO, TA, TI, INVAR 36, QUARTZ, SI AND CAF2. SUBSTRATE TEMPERATURES RANGED FROM 200 TO 350 C. TI SHOWS EXCELLENT PROMISE FOR REDUCING THE TOTAL CELL WEIGHT. ANNEALING, DOPING AND CHEMICAL REACTIONS WERE STUDIED TO INCREASE OUTPUT EFFICIENCIES OF PRODUCTION CELLS. (AUTHOR)

(U)

UNCLASSIFIED

ODC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 434 706

AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

WEBBED DENDRITIC SILICON SOLAR CELL RADIATION EFFECTS
INVESTIGATION. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT., 1 JAN 63-1
JAN 64,

JAN 64 96P BABCOCK, R. V. ; SUN, K. H. ;
CONTRACT: AF33 657 10527
PROJ: 8173
TASK: 817301
MONITOR: APL TDR64 20

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, DAMAGE), (*DAMAGE, SOLAR
CELLS), (*SILICON, SOLAR CELLS), OPTIMIZATION, ELECTRON
BEAMS, MANUFACTURING, STRUCTURAL PROPERTIES, METAL
PLATES, ENERGY CONVERSION, SEMICONDUCTORS, OXYGEN,
VACUUM APPARATUS, VACUUM FURNACES, PERFORMANCE
(ENGINEERING), (U) PERFORMANCE (ENGINEERING) (U)
IDENTIFIERS: DENDRITES (CRYSTALLOGRAPHY), PN
JUNCTIONS (U)

AN INVESTIGATION WAS CONDUCTED TO DETERMINE THE
OPTIMUM STRUCTURE FOR SILICON SOLAR CELLS, WITH
REGARD TO RESISTANCE TO DAMAGE BY 2 MEV
ELECTRONS. THE PARAMETERS CONSIDERED WERE CELL
TYPE, I.E. P/N OR N/P, JUNCTION DEPTH, AND BASE
RESISTIVITY. OF ALL THE PARAMETERS AFFECTING CELL
RADIATION RESISTANCE, THE INITIAL EFFICIENCY WAS
FOUND TO HAVE THE LARGEST EFFECT. A COMPARISON WAS
MADE TO ASSESS THE SUPERIORITY OF THE OPTIMUM N/P
STRUCTURE, FOR 2 MEV ELECTRON FLUX DENSITIES IN
THE RANGE 10 TO THE 13TH 10 TO THE 15TH POWER
ELECTRONS/SQ CM. THE DEGRADATION RATE PER DECADE OF
FLUX FOR THE P/N STRUCTURE WAS ABOUT 25% VS 21%
FOR THE N/P CELLS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 437 942

TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS REPORT NUMBER
VI. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 6, 15
SEP-15 DEC 63,

JAN 64 64P BERMAN, PAUL A. ;

CONTRACT: DA-36-039-SC-90777

PROJ: DA-1G622001A053

TASK: 1G622001A05303

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (+SOLAR CELLS, MANUFACTURING), ENERGY
CONVERSION, DESIGN, COSTS, SILICON (U)

ANALYSIS OF THE PERFORMANCE OF THE PILOT LINE CELLS
FABRICATED DURING THE FOURTH QUARTER INDICATE THAT
THE BASIC CELL DESIGN REMAINS HIGHLY EFFICIENT AT
INTENSITIES UP TO 2000 MW/SQ CM, SHOWING A
SIGNIFICANT IMPROVEMENT IN THE STATE OF THE ART.
ATTEMPTS TO SIGNIFICANTLY REDUCE CELL COSTS BY
REPLACING THE RATHER LENGTHY JUNCTION CLEAN-UP ETCH
BY A SIMPLE EDGE SANDING OPERATION HAVE SHOWN THAT
WHILE SOME MODIFIED TECHNIQUES MAY HAVE VALUE IN THIS
AREA, THE SPECIFIC TECHNIQUE USE IN THE EXPERIMENT
RESULTED IN TOO GREAT A POWER LOSS TO BE OF VALUE
IN REDUCING THE COST PER WATT RATIO. SOME ALTERNATE
TECHNIQUES ARE PROPOSED. RESULTS ARE PRESENTED OF
AN EXPERIMENTS TO DETERMINE THE EFFECT OF VIRGIN AND
SCRAP POLYCRYSTALLINE MATERIAL ON THE EFFICIENCY OF
POLYCRYSTALLINE CELLS. THE RESULTS WERE SOMEWHAT
MASKED BY THE FACT THAT FIVE OF THE EIGHT INGOTS
PURCHASED AS POLYCRYSTALLINE MATERIAL WERE ACTUALLY
PARTIALLY SINGLE CRYSTALLINE IN NATURE. AN
APPENDIX IS INCLUDED DESCRIBING A RADIATION
EXPERIMENT ON N+/P POLYCRYSTALLINE CELLS AND THE
RESULTS ARE COMPARED TO THOSE OBTAINED ON SINGLE
CRYSTALLINE CELLS IN VARIOUS LIGHT SOURCES. THE
RESULTS INDICATE THAT THE N/P POLYCRYSTALLINE AND
SINGLE CRYSTALLINE CELLS DEGRADE TO THE SAME POWER
VALUE AT A FLUX OF ABOUT 10 TO THE 14TH POWER
ELECTRONS/SQ CM IN A SUNLIGHT SOURCE, WITH THE PER
CENT DEGRADATION BEING CONSIDERABLY SMALLER FOR THE
FORMER CELL TYPE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 438 526

GENERAL ELECTRIC CO AUBURN N Y

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR
CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.

6, 1 JAN31 MAR 64,

MAR 64 43P

LAWLER, J. L. ; KILLAM, C. H. ;

CUSANO, D. A. ; LUBOWSKI, S. J. ;

CONTRACT: AF33 657 10601

TASK: 817301 33

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS,
TELLURIDES), (*TELLURIDES, SOLAR CELLS), VAPOR PLATING,
MANUFACTURING, IMPURITIES, CADMIUM, TELLURIUM, IODIDES,
SEMICONDUCTORS, MOLYBDENUM, DIODES, VOLTAGE, ELECTRIC
CURRENTS, SELENIDES, HEAT TREATMENT, SINGLE CRYSTALS,
METAL CRYSTALS, SOLAR PANELS, ELECTRIC CONNECTORS, GOLD,
ELECTRODES

(U)

IDENTIFIERS: CADMIUM SELENIDE, CADMIUM IODIDE,
SUBSTRATES(ELECTRONIC), SUBSTRATES(ELECTRONICS), THIN
FILM ELECTRONICS, THIN FILMS

(U)

THIS REPORT DISCUSSES RESEARCH ON THIN FILM
CDTE SOLAR CELLS CARRIED ON DURING THE FIRST
QUARTER OF 1964. CHANGES IN THE DESIGN OF THE
VAPOR REACTION APPARATUS ARE DESCRIBED AND EVALUATED.
THE EFFECTS OF CHANGES IN THE GROWTH CONDITIONS ARE
DESCRIBED. FILM ADHERENCE WAS FOUND TO IMPROVE
GREATLY CONCURRENTLY WITH THE USE OF GENERAL
ELECTRIC CO. MOLYBDENUM SUBSTRATES. STUDIES OF
THE EVAPORATED ELECTRODES WERE CONTINUED AND SOME
WORK WAS DONE ON PLATED AND SILK-SCREENED ELECTRODES.
BOTH SOLDERED AND EPOXY-BONDED CONNECTIONS TO THE
EVAPORATED GRID WERE EXAMINED, WITH THE LATTER
BELIEVED TO BE THE SUPERIOR TECHNIQUE. STUDIES OF
THE EFFECTS OF CRYSTAL ORIENTATION ON CELL
CHARACTERISTICS ARE REPORTED. AN IMPROVED CDSE
CELL IS DESCRIBED AND FURTHER WORK ON A N-ON-P CELL
IS REPORTED. A LIST OF REPRESENTATIVE CELLS
FABRICATED DURING THE QUARTER IS INCLUDED.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 451 543

WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA

DENDRITIC SOLAR CELL AND ARRAY INVESTIGATION. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 4, 1 JUNE-1
SEP 64,

SEP 64 106P TARNEJA, K. S. ;

CONTRACT: AF33 615 1049

PROJ: 8173

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), SILICON,
SOLAR PANELS, DESIGN, CRYSTAL STRUCTURES, RESISTANCE
(ELECTRICAL), VOLTAGE, PROTON BOMBARDMENT, ELECTRON,
ELECTRON DENSITY, AIR, VACUUM, TARGETS, ALUMINUM,
EPITAXIAL GROWTH, STRUCTURAL PROPERTIES, MECHANICAL
PROPERTIES (U)

IDENTIFIERS: DENDRITES(CRYSTALLOGRAPHY) (U)

THE ONE-YEAR EFFORT IS DISCUSSED FOR MAXIMIZING THE
RADIATION RESISTANCE OF SILICON WEBBED DENDRITES
USING NOVEL APPROACHES SUCH AS INTRODUCTION OF DRIFT
FIELDS. DESIGN CONSIDERATIONS AND FABRICATION
TECHNIQUES FOR SOLAR CELLS USING DRIFT-FIELD
STRUCTURES ARE PRESENTED. THREE DIFFERENT
APPROACHES FOR ACHIEVING GRADED BASE STRUCTURES ARE
DISCUSSED. RESULTS ON SOLAR CELLS FABRICATED USING
THESE APPROACHES ARE PRESENTED. DESIGN
CONSIDERATIONS AND ANALYSIS OF VARIOUS SUBSTRUCTURES
FOR SOLAR CELL PANEL ASSEMBLY ARE DISCUSSED.
EFFORTS WERE DEVOTED TO THE DESIGN OF SOLAR CELL
PANELS FOR THE PURPOSES OF IMPROVING WATTS/LB.
ANTIREFLECTIVE COATINGS WERE APPLIED ON SOLAR CELLS
FABRICATED FROM SILICON WEBBED DENDRITES.
IRRADIATION STUDIES USING 1 MEV ELECTRON ENERGY
ON THE VARIOUS DRIFT FIELD STRUCTURES ARE PRESENTED.
IRRADIATION EXPERIMENTS ON P/N AND N/P SOLAR
CELLS IN VACUUM AND IN AIR WERE CARRIED ON AND THE
RESULTS DISCUSSED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 454 009

TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: REPT. NO. 8 (FINAL), 15 JUN 62-15
JUL 64,

AUG 64 IV BERMAN, PAUL A. ;
CONTRACT: DA36 0395C90777
PROJ: 1G6 22001A053 03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (SOLAR CELLS, MANUFACTURING), SILICON,
COSTS, ENERGY CONVERSION, DESIGN, EFFECTIVENESS,
ELECTRICAL PROPERTIES, VOLTAGE

(U)

EXPERIMENTS LEADING TO AN OPTIMIZED DESIGN FOR N+/P AND P+/N SOLAR CELLS WHICH ARE TO BE UTILIZED IN A TERRESTRIAL ENVIRONMENT AT A SOLAR INTENSITY OF ABOUT 350 MW/SQ CM ARE DESCRIBED. THE SAME CELL DESIGN IS SHOWN TO BE OPTIMIZED FOR 100 MW/SQ CM EARTH'S SURFACE SOLAR INTENSITIES AS WELL. IT IS FOUND THAT THE RESULTS OF THE EXPERIMENTS CAN BE PREDICTED FROM THEORY TO A GOOD APPROXIMATION. PILOT LINE PRODUCTION OF CELLS UTILIZING THE OPTIMIZED DESIGN IS DESCRIBED AND YIELD DISTRIBUTIONS ARE PRESENTED. GOOD EFFICIENCY YIELDS ARE FOUND TO OCCUR FOR BOTH POLARITIES, HOWEVER THE YIELD DISTRIBUTION OF THE P+/N CELLS IS SUPERIOR TO THAT OF THE N+/P CELLS. THE P+/N DISTRIBUTION PEAKS IN THE 13.5-14.0% EFFICIENCY RANGE WITH A YIELD OF 70% OF THE CELLS HAVING AN EFFICIENCY OF 12.9% OR GREATER. THE YIELD DISTRIBUTIONS ARE DISCUSSED IN THE LIGHT OF FURTHER ANALYSIS OF THE ELECTRICAL CHARACTERISTICS OF THE CELLS. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 462 346

ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

THE EFFECT OF 4 MEV ELECTRONS ON COVERED BRITISH
SILICON SOLAR CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
FEB 65 23P TREBLE, F. C. ;
REPT. NO. TR-65026

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, RADIATION EFFECTS),
(*SILICON, ELECTRON IRRADIATION), ELECTRONS, LIGHT,
SOLAR RADIATION, CALIBRATION, DISTRIBUTION, MEASUREMENT,
INTENSITY, DEGRADATION, ELECTRICAL PROPERTIES (U)

AN EXPERIMENTAL STUDY HAS BEEN MADE OF THE EFFECTS
OF 4 MEV ELECTRON BOMBARDMENT ON THE SPECTRAL
RESPONSE AND ORBITAL PERFORMANCE OF TWO BRITISH
MAKES OF 10 OHM CM N/P SILICON SOLAR CELLS WITH
CEMENTED-ON 0.006-IN. GLASS COVER SLIPS. A
SUBSIDIARY PURPOSE OF THE STUDY WAS TO COMPARE THE
LATEST MEASUREMENT TECHNIQUES EMPLOYING SHORT CIRCUIT
CURRENT CALIBRATIONS IN THE LABORATORY WITH THOSE IN
MALTA SUNLIGHT. THE TWO METHODS WERE FOUND TO
GIVE RESULTS IN CLOSE AGREEMENT. A FACTOR RELATING
THE MEAN MALTA CALIBRATION TO THE AIR MASS ZERO
SHORT-CIRCUIT CURRENT WAS ESTABLISHED AND FOUND TO BE
REMARKABLY INSENSITIVE TO SHIFTS IN SPECTRAL RESPONSE
OF THE CELLS. THE RESULTS OF THE STUDY ARE
PRESENTED AS A SERIES OF MEAN SPECTRAL RESPONSE AND
VOLTAGECURRENT CURVES SHOWING THE EFFECT OF VARIOUS
RADIATION FLUXES. THE PERFORMANCE PARAMETERS OF
INTEREST ARE ALSO PLOTTED AS A FUNCTION OF ELECTRON
FLUX. THE PROBABLE FALL IN SOLAR CELL OUTPUT
DURING THE LIFE OF THE UK.3 SATELLITE IS PREDICTED
FROM THE DATA. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 476 696 10/2
RCA LABS DIV RADIO CORP OF AMERICA PRINCETON N J

IMPROVED THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 16 NOV 64-15 NOV 65,
JAN 66 65P PERKINS, DAVID M.; HUI,
WILLIAM L.; NOEL, GERALD; PASIERB, EDWARD F.;

CONTRACT: AF33(615)-2259
PROJ: AF-8173
TASK: 817301-34
MONITOR: AFAPL TR-65-123

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, FILMS), COSTS, WEIGHT,
MANUFACTURING, ABSORPTION, GALLIUM COMPOUNDS, ARSENIC
COMPOUNDS, OXIDES, SINGLE CRYSTALS, CRYSTAL GROWTH,
THICKNESS, DOPING, GRAIN BOUNDARIES, PLATINUM, SILICON
COATINGS, ETCHING, ANNEALING, DEGRADATION, HUMIDITY,
TEMPERATURE, STABILITY (U)
IDENTIFIERS: ANTIREFLECTION COATINGS, THIN FILMS (U)

DURING THIS CONTRACT THIN-FILM GAAS SOLAR CELLS
USING SEMITRANSSPARENT PT LAYERS AS THE BARRIER
CONTACT HAVE BEEN MADE AND INVESTIGATED TO IMPROVE
THEIR PHOTOVOLTAIC CHARACTERISTICS. STUDIES OF THE
GAAS FILM, GROWN BY THE CLOSE-SPACED OXIDE
TRANSPORT PROCESS, AND THE BARRIER CONTACT STRUCTURE,
CONSISTING OF THE PT FILM, GRIDGING AND
ANTIREFLECTION COATING, LED TO THE FABRICATION OF
CELLS WITH THE FOLLOWING MAXIMUM EFFICIENCIES:
5.1% FOR 0.2 CC, 4.5% FOR 2.0 CC AND 3% FOR 4.0
CC. IT WAS SHOWN THAT DEGRADATION OF THESE CELLS
IN ROOM AMBIENT IS DUE TO THE POST-EVAPORATION
ETCHING USED DURING THE FABRICATION PROCESS.
STABLE CELLS WERE MADE WITH EFFICIENCIES OF 2.8%
FOR AREAS OF 2.0 CC. TESTS WERE MADE TO EVALUATE
THE EFFECTS OF TEMPERATURE, VACUUM, MOISTURE,
ULTRAVIOLET LIGHT, AND PROTON RADIATION ON THE PT-
GAAS STRUCTURE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 477 447 10/2 13/8
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

MANUFACTURING METHODS FOR SILICON DENDRITE SOLAR
CELLS. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 MAY 63-31 JUL 65,
DEC 65 117P ICHIKAWA ,Y. ;KISINKO ,P. M.
;MANDALAKAS ,J. N. ;MERRITTS ,T. D. ;
STONEBRAKER,E. R. ;
CONTRACT: AF33(657)-11274
PROJ: MM-8-130
MONITOR: AFML TR-65-413

UNCLASSIFIED REPORT

DESCRIPTORS: (+SOLAR CELLS, PRODUCTION), SILICON,
CRYSTAL GROWTH, DIFFUSION, TEST METHODS, SIMULATION,
INDUSTRIAL EQUIPMENT, MANUFACTURING, POWER SUPPLIES (U)

TECHNIQUES FOR PRODUCING LOW-COST, HIGH EFFICIENCY,
SILICON WEB DENDRITE SOLAR CELLS ON AN UNBALANCED
PILOT LINE ARE REPORTED. SILICON DENDRITIC WEB
(0.5 X 12 IN.) HAVING THICKNESS, RESISTIVITY, AND
CRYSTAL PROPERTIES FOR DEVICE OBJECTIVES WAS
PRODUCED. SILICON DENDRITIC WFB N-ON-P SOLAR
CELLS (1.27 X 30.5 CM) WERE FABRICATED DURING THE
PILOT RUN. PROCESSES WERE DESIGNED TO ASSURE A
YIELD OF 75% OF 9% MINIMUM EFFICIENT CELLS.
THE DISTRIBUTION OF YIELD BASED ON SOLAR CELL
EFFICIENCY WAS > OR = 9%, 100%; > OR = 10%,
68%; AND > OR = 11%, 18%. THE OVERALL
PHYSICAL YIELD WAS 78% DURING THE OPERATION OF THE
UNBALANCED PILOT LINE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 477 592 10/2 18/8
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF

GAMMA RADIATION EFFECTS IN SILICON SOLAR CELLS, (U)

OCT 58 37P ENSLOW, G. ; JUNG, F. ;
HAPP, W. W. ;
REPT. NO. LMSD-5137
CONTRACT: AFD4(647)-97

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), SILICON, GAMMA
RAYS, ELECTRICAL PROPERTIES, POWER SUPPLIES, (U)POWER
SUPPLIES (U)

TEN SILICON SOLAR CELLS WERE IRRADIATED BY 100-
CURIE CO 60 GAMMA RAY SOURCE TO A DOSE OF 10 TO THE
7TH POWER R. IN-SITU MEASUREMENTS OF THE OPEN-
CIRCUIT VOLTAGE AND SHORT-CIRCUIT CURRENT WERE
OBTAINED. CALCULATIONS TO PREDICT THE PERFORMANCE
OF SILICON SOLAR CELLS UNDER IRRADIATION WERE MADE ON
THE BASIS OF KNOWN PROPERTIES OF SILICON AND ON THE
BASIS OF MODELS OF RADIATION DAMAGE IN SOLIDS.
CALCULATED AND EXPERIMENTAL RESULTS WERE COMPARED.
THE ELECTRICAL CHARACTERISTICS OF THE SOLAR CELLS
WERE MEASURED AS A FUNCTION OF TEMPERATURE BEFORE AND
AFTER IRRADIATION. THE PERFORMANCE OF A SILICON
SOLAR CELL POWER SUPPLY IN RADIATION FIELDS IS
DISCUSSED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 486 792 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 2, 1 APR-1
JUL 66;

JUL 66 29P HARDING, W. R., JR.
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR CELLS, FEASIBILITY STUDIES),
SILICON, ELECTRICAL RESISTANCE, VOLTAGE, PHOTOENGRAVING,
BORON, COATINGS, PHOSPHORUS, DIFFUSION, EPITAXIAL
GROWTH, ARSENIC, ELECTRICAL CONDUCTIVITY, VAPOR PLATING,
TITANIUM, SILVER, INDIUM, DOPING, REDUCTION, ALIGNMENT,
SEMICONDUCTOR DIODES, CIRCUITS, LEAKAGE(ELECTRICAL),
OSCILLATORS, FREQUENCY CONVERTERS (U)
IDENTIFIERS: PHOTO-RESIST (U)

THIS REPORT COVERS THE PROGRESS ON THE HIGH
VOLTAGE SOLAR CELL ARRAY SEGMENT FOR THE
PERIOD 1 APR TO 1 JULY, 1966. SUITABLE
PHOTORESIST TECHNIQUES FOR WEB SILICON WERE DEVELOPED
DURING THIS PERIOD AND CRITICAL ALIGNMENT AND COATING
TECHNIQUES WERE DESIGNED. THE UTILIZATION OF
SUBCOLLECTORS FOR THE HIGH VOLTAGE CELL IS
DISCUSSED. A MODEL FOR THE HIGH VOLTAGE CELL WAS
SET UP AND ANALYZED. THE POWER LOSSES INHERENT IN
THE STRUCTURE AND THE APPROACHES NEEDED TO SOLVE THEM
WERE INVESTIGATED AND REPORTED. DEVELOPMENT OF THE
OSCILLATOR AND MULTIPLIER CIRCUITS WAS CONTINUED.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 487 633 10/2
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF RESEARCH
LABS

PROTON AND ELECTRON IRRADIATION OF N/P SILICON SOLAR
CELLS, (U)

APR 65 64P REYNARD, D. L. ;
REPT. NO. LMSC-3-56-65-4
CONTRACT: AF 04(647)-787

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR CELLS, SILICON), RADIATION EFFECTS,
PROTONS, ELECTRONS, DEGRADATION, DAMAGE, RADIATION
EFFECTS, ELECTRICAL PROPERTIES, MEASUREMENT,
CALIBRATION (U)

THE RADIATION DEGRADATION DATA FOR TEN OHM-CM N/
P SILICON SOLAR CELLS WHICH EXISTED AT THE
INITIATION OF THIS TEST PROGRAM WAS IN NEED OF
FURTHER SUBSTANTIATION AND IMPROVEMENT. A TEST
PROGRAM WAS THUS COMMENCED WHICH WOULD PROVIDE
COMPLETE AND RELIABLE PERFORMANCE DATA FOR THE
SUPPORT OF THE POWER SYSTEM DESIGN AND THE ASSURANCE
OF THE SYSTEM'S RELIABILITY. SOLAR CELLS WERE
IRRADIATED WITH ELECTRONS WITH FOUR ENERGIES AND
PROTONS WITH THREE ENERGIES. COMPARABLE CELLS
PRODUCED BY FOUR DIFFERENT MANUFACTURERS WERE
INCLUDED. SOLAR CELL/COVER/ADHESIVE COMPOSITE
SAMPLES WERE ELECTRON-IRRADIATED. I-V
CHARACTERISTICS WERE OBTAINED AT INTERMEDIATE, AS
WELL AS FINAL, TOTAL FLUX LEVELS. THE DESIRED TEST
DATA WERE OBTAINED WITH A HIGH DEGREE OF ACCURACY.
THE CELLS OF THE FOUR MANUFACTURERS WERE
SUBSTANTIALLY EQUAL IN RADIATION TOLERANCE. LITTLE
DIFFERENCE WAS NOTED BETWEEN THE PERFORMANCE OF 1 AND
10 OHM-CM CELLS. IT WAS CONCLUDED THAT ONLY POWER
MEASUREMENTS ARE VALID AS CRITERIA FOR RELATIVE POWER
SYSTEM DEGRADATION. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 487 634 10/2
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF

IRRADIATION OF SOLAR CELL SUB-PANELS WITH 0.8 MEV
ELECTRONS.

(U)

NOV 64 22P REYNARD, D. L. ;
REPT. NO. LMSC-3-56-64-8
CONTRACT: AF 04(647)-787

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR CELLS, SILICON), ELECTRONS, DAMAGE,
RADIATION EFFECTS, SENSITIVITY,
PERFORMANCE (ENGINEERING), TEMPERATURE, DEGRADATION (U)

THE SILICON SOLAR CELL HAS RADIATION DEGRADATION CHARACTERISTICS WHICH HAVE BEEN THOROUGHLY INVESTIGATED, AND, AS A RESULT, ARE WELL-ESTABLISHED. THE RADIATION SENSITIVITY OF GROUPS OF THESE CELLS ASSEMBLED INTO MODULES, HOWEVER, HAD NOT BEEN INVESTIGATED PRIOR TO THE PERFORMANCE OF THIS EXPERIMENT. THE OBJECTIVE OF THE EXPERIMENT WAS TO OBSERVE THE SENSITIVITY OF THE LMSC SOLAR CELL SUB-PANEL (A TEN-CELL IN PARALLEL MODULE) AS COMPARED TO SINGLE SOLAR CELLS. ANY VARIATION OF THIS SENSITIVITY AMONG VARIOUS MANUFACTURING BATCHES WAS TO BE ESTABLISHED. AS A RESULT OF THE EXPERIMENT IT WAS FOUND THAT THE MANUFACTURING PROCESSES CURRENTLY USED DO NOT AFFECT THE RADIATION PROPERTIES OF THE MODULE. THE MODULE SUFFERS RADIATION DEGRADATION AT THE SAME RATE AS DO SINGLE SOLAR CELLS. NO BATCH-TO-BATCH DIFFERENCES OF THESE PROPERTIES WERE FOUND. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 601 459

HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO. 2, 25 FEB-25 MAY 64

MAY 64 46P

SCHAEFER, J. C. ; HUMRICK, R. J.

; BELT, R. F. ;

CONTRACT: AF33 615 1248

PROJ: 8173

TASK: 81301, 817332

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS, SULFIDES), VAPOR PLATING, VACUUM APPARATUS, SINGLE CRYSTALS, TITANIUM, COPPER COMPOUNDS, CHLORIDES, INDIUM, MOLYBDENUM, SILICON COMPOUNDS, MONOXIDES, SURFACE PROPERTIES, ENERGY CONVERSION, EFFECTIVENESS

(U)

IDENTIFIERS: THIN FILMS

(M)

CONSIDERABLE EMPHASIS HAS BEEN PLACED ON THE DEVELOPMENT OF THE CHEMIPLATED OR IMMERSION TECHNIQUE FOR THE BARRIER FORMATION. GAINS OF ABOUT 40% IN CONVERSION EFFICIENCY HAVE BEEN REALIZED OVER THE STANDARD EFFICIENCY OF 2.5%. LIGHTER WEIGHT SOLAR CELLS HAVE BEEN FABRICATED ON TITANIUM SUBSTRATES WITH HIGH POWER TO WEIGHT RATIOS. SOLAR CELLS USING H-FILM AS THE SUBSTRATE MATERIAL HAVE BEEN MADE WITH EFFICIENCIES OF OVER 4% AND POWER TO WEIGHT RATIOS GREATER THAN 40. THE VACUUM DEPOSITION OF CDS ON SINGLE CRYSTAL CDS HAS BEEN PERFORMED TO STUDY EFFECTS OF SUBSTRATE PERFECTION ON THE QUALITY OF THE FILM. SOLID STATE REACTIONS OF CUCI AND CDS WERE INVESTIGATED IN ORDER TO PREPARE MORE EFFECTIVE BARRIERS. INDIUM PLATED MO SUBSTRATES WERE UTILIZED TO PROVIDE OHMIC CONTACTS AT THE CDS SUBSTRATE INTERFACE. SPECTRAL RESPONSE OF ELECTROPLATED AND CHEMIPLATED CELLS AS A FUNCTION OF TIME SHOWS THAT THE LATTER APPEAR TO BE MORE STABLE IN ORDINARY AMBIENTS. THE USE OF SiO THIN FILMS ON THE TOP SURFACE OF THE CELLS HAS LED TO A MORE STABLE CELL IN THE PRESENCE OF WATER VAPOR. OPTICAL STUDIES ON THE CHEMIPLATED BARRIER LAYER HAVE CONFIRMED A CU₂-XS COMPOUND OF A THICKNESS OF ABOUT 1800A AND EXHIBITING FREE CARRIER ABSORPTION.

(U)

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UNCLASSIFIED

/ZOM07

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 602 759

TEXTRON ELECTRONICS INC SYLMAR CALIF HELIOTEK DIV

HIGH EFFICIENCY SILICON SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 7, 15 DEC
63-15 MAR 64,

APR 64 53P BERMAN, PAUL A. ;

CONTRACT: DA36 039SC90777

PROJ: 1G6 22001 A053 03

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SILICON, SOLAR
CELLS), (*ENERGY CONVERSION, SOLAR RADIATION), DESIGN,
MANUFACTURING, COSTS, SINTERING, EVAPORATION, DIFFUSION,
CRYSTALS, SEMICONDUCTORS, RESISTANCE (ELECTRICAL),
OPTIMIZATION, MATRICES (MATHEMATICS) (U)

A POLYVARIABLE EXPERIMENT WAS PERFORMED ON P(+)/N
SOLAR CELLS TO DETERMINE THE OPTIMUM DESIGN FOR
PERFORMANCE AT SOLAR INTENSITIES OF ABOUT 350 MW/SQ
CM. THE REGION OF MAXIMUM RESPONSE WAS DETERMINED
AND INDICATED THAT A 13 LINE GRID PATTERN COMBINED
WITH A 12 MINUTE DIFFUSION TIME WOULD GIVE THE
MAXIMUM PERFORMANCE FOR P(+)/N CELLS OPERATED AT
SOLAR INTENSITIES UP TO 350 MW/SQ CM. A
BIVARIABLE EXPERIMENT PERFORMED ON P(+)/N
POLYCRYSTALLINE CELLS HAS SHOWN THAT POLYCRYSTALLINE
CELLS CAN BE OPTIMIZED AND DESIGNED FOR USE IN
CONCENTRATED LIGHT SYSTEMS. IT WAS FOUND THAT CELL
DESIGNS NEAR THE REGION OF MAXIMUM RESPONSE ACTUALLY
SHOWED INCREASED EFFICIENCIES AT 316 MW/SQ CM
EQUIVALENT SOLAR INTENSITIES. THE FABRICATION OF
CELLS HAVING FROM 4 TO 8 TIMES THE ACTIVE AREA OF THE
NORMAL 1 X 2 CM CELL INDICATES THAT LARGE AREA CELLS
CAN BE MADE WITH SHORT CIRCUIT CURRENT DENSITIES AND
OPEN CIRCUIT VOLTAGES THAT COMPARE QUITE CLOSELY WITH
THOSE OBTAINED FROM 1 X 2 CM. INVESTIGATIONS HAVE
BEEN MADE TO DETERMINE METHODS OF ELIMINATING THE
TIME CONSUMING AND RELATIVELY EXPENSIVE JUNCTION
CLEAN UP ETCH WITH A MORE RAPID, LESS COSTLY PROCESS.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 605 425

HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF THIN FILM CADMIUM SULFIDE SOLAR
CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.
3, 26 MAY-25 AUG 64,

AUG 64

8P

SCHAEFER, J. C. ; HUMRICK, R. J. ;

BELT, R. F. ;

CONTRACT: AF33 615 1248

PROJ: 8173

TASK: 817301, 817332

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-601 459.

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS,
SULFIDES), ENERGY CONVERSION, BATTERIES AND COMPONENTS,
ELECTROPLATING, VAPOR PLATING, DEGRADATION, CHEMICAL
MILLING, COPPER COMPOUNDS, CHLORIDES, SILICON COMPOUNDS,
MONOXIDES, SURFACE PROPERTIES, EFFECTIVENESS (U)
IDENTIFIERS: THIN FILMS (M)

THE DEGRADATION OF ELECTROPLATED CELLS HAS BEEN
CLOSELY OBSERVED AND IT HAS BEEN FOUND THAT RECOVERY
CAN BE ACCOMPLISHED UNDER PROPER CONDITIONS.
CHEMICAL MILLING OF THE SUBSTRATE IS AN EXCELLENT
METHOD FOR PRODUCING HIGH POWER TO WEIGHT RATIO
CELLS. FABRICATION OF THE ONE-HALF AND ONE SQUARE
FOOT MECHANICAL SAMPLE ARRAYS INDICATE IMPROVED TOTAL
AREA UTILIZATION FACTORS. PHOTOVOLTAIC CELLS AND
DIODES HAVE BEEN PREPARED BY FIRST DEPOSITING A THIN
FILM OF CUCL ON CDS. THE CUCL WAS
SUBSEQUENTLY CONVERTED TO CU₉SS₅ BY MEANS OF
H₂S. OPTICAL STUDIES ON ELECTROPLATED AND
CHEMIPLATED BARRIERS HAVE SERVED TO CONFIRM THE
PRESENCE OF CU₂S ALONE OR MIXED WITH CUS.
THIN LAYERS OF SiO₂ HAVE BEEN UTILIZED AS A
WATER VAPOR BARRIER TO SIGNIFICANTLY DECREASE
DEGRADATION OF CELLS. ADDITIONAL THEORETICAL WORK
HAS BEEN PERFORMED ON A HETEROJUNCTION MODEL OF THE
CELL OPERATION. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 605 931

GENERAL INSTRUMENT CORP NEWARK N J

SOLAR FLAT PLATE THERMOELECTRIC GENERATOR RESEARCH,

(U)

SEP 64 98P RUSH, ROBERT E. :

CONTRACT: AF 33(657)-10335

PROJ: AF-8173

TASK: 817302

MONITOR: AFAPL TDR-64-87

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR PANELS, THERMOELECTRICITY),
(*THERMOELECTRICITY, SOLAR PANELS), GENERATORS, ENERGY
CONVERSION, SOLAR RADIATION, OPTICAL COATINGS,
ELECTRICAL POWER PRODUCTION, STRUCTURAL MEMBERS,
ALUMINUM, ENVIRONMENTAL TESTS, BISMUTH ALLOYS, TELLURIUM
ALLOYS, SPACECRAFT, POWER SUPPLIES, EXPANDED PLASTICS,
HONEYCOMB CORES, METAL PLATES, JOINING, PERFORMANCE
(ENGINEERING), CORROSION, LITHIUM, LIQUID METALS,
SUBLIMATION, DESIGN, STORAGE, SEMICONDUCTORS,
THERMOCOUPLES

(U)

A SOLAR FLAT PLATE THERMOELECTRIC CONVERTER
CONSISTS OF A COLLECTOR PLATE WITH AN OPTICALLY
SELECTIVE COATING, SMALL SIZE THERMOELEMENTS, A
RADIATOR PLATE AND A SUPPORT. THE COLLECTOR AND
RADIATOR PLATES WERE FOLDED INTO SELF-SUPPORTING
STRUCTURES WHICH, COMBINED WITH ALUMINUM TUBULAR
MEMBERS, COMPRISED THE PANEL SUPPORT CONFIGURATION.
THIS DESIGN RESULTED IN A VERY LOW CONVERTER
WEIGHT, ONLY 53 GRAMS PER SQUARE FOOT. A NUMBER OF
PROTOTYPE PANELS, WERE FABRICATED AND TESTED. THE
PANELS PASSED SPECIFIED ENVIRONMENTAL TEST WITHOUT
PHYSICAL OR ELECTRICAL CHANGES. EVALUATION OF THE
OPTICALLY SELECTIVE COATING DISCLOSED THAT THE
COATING EFFICIENCY ACTUALLY OBTAINED IN THE PILOT
PRODUCTION RUNS WAS ONLY 80% OF THE LITERATURE
VALUE. THE PROCESSING OF THE BISMUTH TELLURIDE
THERMOELECTRIC MATERIAL INTO THE SHAPE AND SIZE
REQUIRED FOR THE SOLAR PANELS CAUSED A DECREASE IN
PERFORMANCE RELATIVE TO LARGE SIZE THERMOELEMENTS.
THIS DECREASE, COMBINED WITH BASIC MATERIAL
PROPERTIES INFERIOR TO LITERATURE VALUES, RESULTED IN
A THERMOELECTRIC EFFICIENCY ONLY 50% OF THAT
INITIALLY EXPECTED.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 605 957

TRW SPACE TECHNOLOGY LABS LOS ANGELES CALIF

DESIGN CRITERIA FOR SILICON SOLAR CELL POWER
SUPPLIES,

(U)

FEB 59 8P ROBISON, P. C. ;
REPT. NO. STL/TN-59-0000-00234

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*SPACECRAFT,
POWER SUPPLIES), (*POWER SUPPLIES, SOLAR CELLS), DESIGN,
COATINGS, GEOMETRIC FORMS, ELECTRICAL PROPERTIES,
TEMPERATURE, TEMPERATURE CONTROL, SOLAR RADIATION,
GLASS, SOLAR PANELS, EMISSIVITY, ELECTRIC CURRENTS,
ENERGY CONVERSION, MATHEMATICAL ANALYSIS, PERFORMANCE
(ENGINEERING), SPACE PROBES (U)

GENERAL PRINCIPLES OF DESIGN ARE OUTLINED FOR THE
USE OF SILICON SOLAR CELLS FOR POWER IN SPACE PROBES.
SEVERAL ELECTRICAL CHARACTERISTICS IMPORTANT TO
DESIGN ARE CONSIDERED. ANALYSIS OF POSSIBLE
GEOMETRIC CONFIGURATIONS OF SOLAR CELLS IS GIVEN
ALONG WITH A SEMI-EMPIRICAL METHOD. MENTION IS
MADE OF TEMPERATURES AND TEMPERATURE CONTROL. THE
RESULTS ARE USED TO INDICATE A DESIGN APPROACH. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 609 213
NAVAL RESEARCH LAB WASHINGTON D C

ELECTRON-BOMBARDMENT DAMAGE IN SILICON SOLAR
CELLS.

(U)

DESCRIPTIVE NOTE: FINAL REPT.,
OCT 64 62P STATLER, R. L. ;
REPT. NO. NRL-6091
PROJ: SFO13 12 04 4533 ,SR007 11 01 0549

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR CELLS, DAMAGE), (SILICON, ELECTRON
IRRADIATION), SEMICONDUCTOR DEVICES, ELECTRICAL
PROPERTIES, PHOTOELECTRIC EFFECT, SATELLITES
(ARTIFICIAL), POWER SUPPLIES, (U)POWER SUPPLIES (U)

A STUDY WAS MADE OF THE RADIATION DAMAGE IN 11
TYPES OF SILICON SOLAR CELLS AS A RESULT OF 1-MEV
ELECTRON BOMBARDMENT. INCLUDED IN THE STUDY ARE P/
N CELLS, N/P CELLS OF DIFFERENT BULK RESISTIVITIES,
PLANAR CELLS, AND DRIFT-FIELD CELLS. A COMPARATIVE
ANALYSIS WAS MADE OF THE RADIATION-INDUCED DEGRADATION
IN THESE CELLS AS A FUNCTION OF SHORTCIRCUIT CURRENT,
MAXIMUM POWER OUTPUT, MINORITY-CARRIER DIFFUSION
LENGTH, AND PHOTOVOLTAIC SPECTRAL RESPONSE. THE P/
N CELLS WERE FOUND TO BE MUCH MORE SENSITIVE TO
RADIATION DAMAGE THAN ANY TYPE OF N/P CELLS IN THIS
INVESTIGATION. IN THE N/P CELLS, THERE IS A
DEFINITE INDICATION OF INCREASING RADIATION
RESISTANCE ACCOMPANYING INCREASING VALUES OF BULK
RESISTIVITY, UP TO 10 OHM-CM. THE DRIFT-FIELD
SOLAR CELLS EXHIBIT A FURTHER IMPROVEMENT IN
RADIATION RESISTANCE BEYOND THAT OF THE OTHER TYPES
OF N/P CELLS. (AUTHOR) (U)

UNCLASSIFIED

ODC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 609 204

NATIONAL CASH REGISTER CO DAYTON OHIO

INVESTIGATION OF CHEMICALLY SPRAYED THINFILM
PHOTOVOLTAIC CELLS.

(U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 2, 15 AUG-14 NOV
64,

NOV 64 36P CHAMBERLIN, R. R. ; SKARMAN, J. S.

;

CONTRACT: AF33 615 1578

PROJ: 8173

TASK: 817301

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: LEGIBILITY OF THIS DOCUMENT IS IN PART
UNSATISFACTORY. REPRODUCTION HAS BEEN MADE FROM THE BEST
AVAILABLE COPY.

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING),
(*PHOTOELECTRIC CELLS (SEMICONDUCTOR), MANUFACTURING),
(*SEMICONDUCTING FILMS, SULFIDES), COPPER COMPOUNDS,
CADMIUM COMPOUNDS, SPRAYS, BRONZE, STEEL, TEST
FACILITIES, COMPLEX COMPOUNDS (U)
IDENTIFIERS: CADMIUM SULFIDES, COPPER SULFIDES, THIN
FILMS (U)

THE REPORT DISCUSSES THE DETAILS OF THE CHEMICAL
SPRAY DEPOSITION TECHNIQUE THAT WAS USED FOR THE
DEPOSITION OF THE CDS AND CU SUB X S SUB Y
SEMICONDUCTOR FILMS. TOPICS INCLUDE FILM
DEPOSITION TECHNIQUES, FILM STUDIES, CELL
FABRICATION, AND TEST INSTALLATION. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 609 424

TRW SPACE TECHNOLOGY LABS LOS ANGELES CALIF

ELECTRON BOMBARDMENT OF SILICON SOLAR CELLS, (U)

FEB 60 52P DOWNING, R. G. ;
REPT. NO. STL/TR-60-0000-04057 , STL/EM-10-5

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, ELECTRON IRRADIATION),
(*DAMAGE, SOLAR CELLS), SILICON, PHOTOELECTRIC CELLS
(SEMICONDUCTOR), SEMICONDUCTORS, QUARTZ, GLASS,
SHIELDING, CRYSTAL DEFECTS, HEAT TREATMENT,
SEMICONDUCTOR DEVICES, SATELLITES (ARTIFICIAL),
SPACECRAFT, GRAPHICS, (U)GRAPHICS (U)

SILICON SOLAR CELLS WERE IRRADIATED WITH 500 KEV
ELECTRONS TO DETERMINE THE EFFECT OF ELECTRON
RADIATION SIMILAR TO THAT ENCOUNTERED IN SATELLITES
ON THE EFFICIENCY OF SOLAR CELLS. THE EXPERIMENTS
SHOW THAT AN INTEGRATED FLUX OF ABOUT 5×10 TO THE
13TH POWER E/SQ CM REDUCES SILICON SOLAR CELL
EFFICIENCY BY ABOUT 25 PERCENT. ADDITIONAL
EXPERIMENTS USING QUARTZ AND GLASS SHIELDING FOR
RADIATION PROTECTION SHOW THE SUITABILITY OF REDUCING
THE RADIATION DAMAGE BY THIS TECHNIQUE. COMBINING
THE EXPERIMENTAL RESULTS WITH THE SIMPLE THEORY,
0.065 IN. OF QUARTZ OR GLASS ARE INDICATED AS
NECESSARY TO PROVIDE PROTECTION FROM 800 KEV
ELECTRONS IN THE TRAPPED RADIATION BANDS.
ADDITIONAL PROTECTION OF SHIELDED SILICON SOLAR
CELLS WILL RESULT FROM ANNEALING OF RADIATION INDUCED
DEFECTS AT A LOW RATE NEAR ROOM TEMPERATURES. NO
QUANTITATIVE DATA ON ANNEALING WAS OBTAINED FROM
THESE EXPERIMENTS, BUT THIS EFFECT SHOULD BE REGARDED
AS A SUBJECT FOR FURTHER INVESTIGATION IN ADDITION TO
DETAILED INVESTIGATION OF RADIATION DAMAGE IN SILICON
SOLAR CELLS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 610 356

FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

ELECTRIC POWER STATION IN THE COSMOS,

(U)

JAN 65 6P MARININ, YURII ;
REPT. NO. FTD-TT-64-633
MONITOR: TT , 65 61029

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: UNEDITED ROUGH DRAFT TRANS. FROM
SOVETSKAYA BELORUSSIYA (USSR) 1963, 9 JUL, P. 3.

DESCRIPTORS: (*ELECTRIC POWER PRODUCTION, SPACE FLIGHT),
(*SOLAR CELLS, SPACE FLIGHT), (*SOLAR PANELS, SPACE
FLIGHT), (*SPACE FLIGHT, ELECTRIC POWER PRODUCTION),
USSR, RADIOACTIVE ISOTOPES, NUCLEAR REACTORS,
RADIOACTIVE CONTAMINATION, MOON, POWER SUPPLIES (U)
IDENTIFIERS: MARINER, TRANSIT (U)

AN ACCOUNT IS GIVEN OF GENERATION OF ELECTRIC POWER
FOR TRAVEL BY ROCKETS, SATELLITES, AND SPACE SHIPS.
THE POWER IS GENERATED BY SOLAR MEANS, RADIOACTIVE
ISOTOPES, OR NUCLEAR REACTORS. BRIEF MENTION IS
MADE OF THE FLIGHT OF 'MARINER II' TOWARD VENUS
AND OF THE USE OF RADIOISOTOPES FOR THE AMERICAN
NAVIGATIONAL SATELLITES 'TRANSIT IV A' AND
'TRANSIT IV B'. RADIOACTIVE CONTAMINATION OF THE
MOON OR OF ANY OTHER PLANET ON WHICH LANDINGS MIGHT
BE MADE IS ALSO DISCUSSED. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 611 535

GENERAL ELECTRIC CO AUBURN N Y

RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR
CELLS.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 1 SEP 62 - 31 DEC 64,
FEB 65 193P ALDRICH, RICHARD W. ;CUSANO,

DOMINIC A. I

CONTRACT: AF 33(657)-10601

PROJ: AF-8173

TASK: 817301

MONITOR: AFAPL

TR-65-8

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-438 526

DESCRIPTORS: (*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS,
TELLURIDES), SEMICONDUCTORS, SINGLE CRYSTALS, VAPOR
PLATING, MOLYBDENUM, MANUFACTURING, IMPURITIES, POWDERS,
DIODES (SEMICONDUCTOR), GOLD, ELECTRIC CONNECTORS,
ENCAPSULATION, SILICON COATINGS, METAL COATINGS, PLASTIC
COATINGS, OXIDES, HEAT TREATMENT, VOLTAGE, INDIUM
COMPOUNDS, COPPER COMPOUNDS, SELENIDES, STORAGE,
ENVIRONMENTAL TESTS

(U)

IDENTIFIERS: CADMIUM TELLURIDE, COPPER TELLURIDE,
INDIUM(III) OXIDE

(U)

LARGE-AREA (56 SQ CM) CELLS THAT WERE 4.68
EFFICIENT AND A SOLAR PANEL - 1/2 SQ FT IN AREA -
WERE FABRICATED. ON THE AVERAGE, THE EFFICIENCY,
THE POWER OUTPUT PER UNIT WEIGHT, AND THE YIELD OF
LARGE AREA SOLAR CELLS MADE FROM CADMIUM TELLURIDE
FILMS ALL INCREASED MONOTONICALLY DURING THE CONTRACT
PERIOD (1 SEPTEMBER 1962 TO 31 DECEMBER 1964).
THE COMPOSITE OBJECTIVE FOR THE RUN OF THE CONTRACT
WAS THE DEVELOPMENT OF LIGHTWEIGHT, FLEXIBLE, SOLAR
CELLS OF APPROXIMATELY 5% MAXIMUM EFFICIENCY.
THE SEMICONDUCTOR MATERIAL WAS TO BE
POLYCRYSTALLINE CADMIUM TELLURIDE. THE CELLS WERE
TO WITHSTAND, OR SHOW PROMISE OF WITHSTANDING,
WITHOUT DETERIORATION A NORMAL LABORATORY
ENVIRONMENT, PARTICLE AND ULTRA-VIOLET RADIATION,
HIGH AND LOW TEMPERATURES, AND VACUUM. THE VARIOUS
INVESTIGATIONS THAT WERE UNDERTAKEN TO ACHIEVE SUCH
LARGE AREA CELLS ARE DISCUSSED IN DETAIL IN THIS
REPORT. THE INVESTIGATIONS INCLUDE STUDIES OF
PHOTOVOLTAIC JUNCTIONS, FILM GROWTH TECHNIQUES,
COLLECTOR ELECTRODES, COLLECTOR BUSBARS, AND
CAPSULATION TECHNIQUES. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 612 485

WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

DENDRITIC SOLAR CELL AND ARRAY INVESTIGATION. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 6, 1 DEC
64-1 MAR 65,

MAR 65 36P TARNEJA, K. S. ;

CONTRACT: AF33 615 1049

PROJ: 8173

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING),
(*SEMICONDUCTING FILMS, SOLAR CELLS), (*EPITAXIAL
GROWTH, SEMICONDUCTING FILMS), SILICON COMPOUNDS,
OXIDES, SINGLE CRYSTALS, SILICON, SEMICONDUCTOR DEVICES,
FILMS, DAMAGE, RADIATION EFFECTS, ALUMINUM, CERAMIC
COATINGS, DRIFT, STRUCTURE, DESIGN, IMPURITIES, BORON(U)
IDENTIFIERS: STRUCTURE (M)

THE REPORT DISCUSSES THE CONTINUED DEVELOPMENT OF
DRIFT FIELD SOLAR CELLS USING EPITAXIAL GROWTH
TECHNIQUES AND SOLAR CELL PANEL FABRICATION AND ARRAY
DESIGN STUDIES. MODIFICATIONS IN THE GRAPHITE
RESISTANCE EPITAXIAL SYSTEM ARE DISCUSSED.
ATTEMPTS TO GROW SiO₂ FILMS DIRECTLY ON THE
DIFFUSED CELL SURFACE WERE MADE. RESULTS OF THE
IRRADIATION SERIES OF 1 MEV ELECTRONS ON Al-
DOPED SOLAR CELLS ARE PRESENTED. THE MODULE AND
THE PANEL SIZE USING THE 'SLOTTED ANGLE' DESIGN HAS
BEEN FINALIZED. DESIGN STUDIES OF ARRAYS UP TO 20
SQUARE FEET ARE PRESENTED AND DISCUSSED. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 613 187
HARSHAW CHEMICAL CO CLEVELAND OHIO

INVESTIGATION OF CDS THIN-FILM SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: REPT. FOR NOV 63-DEC 64.

FEB 65 122P

CONTRACT: AF 33(615)-1248

PROJ: AF-8173

TASK: 817301

MONITOR: AFAPL

TR-65-1

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-605 425.

DESCRIPTORS: (*SEMICONDUCTING FILMS, SOLAR CELLS),
(*SOLAR CELLS, FILMS), (*CADMIUM COMPOUNDS, SULFIDES),
ENERGY CONVERSION, PLATING, COPPER COMPOUNDS, CHLORIDES,
VAPOR PLATING, VACUUM APPARATUS, SILICON COMPOUNDS,
MONOXIDES, DEGRADATION, SURFACE PROPERTIES, DAMAGE,
RADIATION EFFECTS, EFFECTIVENESS, ENVIRONMENTAL TESTS,
MOLYBDENUM, QUARTZ, TANTALUM, SILICON, CALCIUM
COMPOUNDS, FLUORIDES, TITANIUM, NICKEL ALLOYS, IRON
ALLOYS, SINGLE CRYSTALS
IDENTIFIERS: CADMIUM SULFIDES, THIN FILMS

(U)

(U)

RESEARCH AND DEVELOPMENT OF FRONT WALL, THIN FILM,
FLEXIBLE, LIGHT WEIGHT CDS SOLAR CELLS WAS
CONTINUED AND DECIDED IMPROVEMENTS HAVE BEEN
ACCOMPLISHED. A ONE SQUARE FOOT ARRAY SHOWS A
POWER TO WEIGHT RATIO OF ABOUT 35.0 WATTS/LB. WITH AN
OVERALL AREA UTILIZATION FACTOR OF OVER 0.80. A
NEW CHEMICAL BARRIER FORMATION PROCESS WAS DEVELOPED
PROVIDING HIGHER CELL EFFICIENCIES. EXPOSURE OF
CELLS TO ELECTRON, PROTON AND COBALT 60 RADIATION
SHOW LITTLE OR NO DAMAGE. STUDIES ON THE FORMATION
OF THE CDS LAYER INDICATE A HIGHER DEGREE OF
PREFERRED ORIENTATION AND CRYSTALLITE SIZE AS THE
SUBSTRATE TEMPERATURE INCREASES. CRYSTALLITES OF
100 MICRON DIMENSION WERE OBSERVED. OPTICAL
MEASUREMENTS ON THE P-LAYER CONFIRM THE CONCLUSION
THAT THE BARRIER LAYER IS A HIGHLY CONDUCTING COPPER
SULFIDE. OVERLAYERS OF SIO DEPOSITED ON THE
CELL DECREASE THE RATE OF WATER VAPOR DEGRADATION,
BUT MECHANICAL IMPERFECTIONS RESTRICT THE THICKNESS
OF THE DEPOSITED LAYER. THEORETICAL ANALYSIS OF THE
EXPERIMENTAL DATA SHOW SERIOUS AND PROBABLY
INSURMOUNTABLE PROBLEMS WITH APPLICATION OF EITHER A
SURFACE STATE OR TRAP MODEL FOR THE CDS SOLAR
CELL. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 622 483

JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS
LAB

EFFECTS OF PASSIVE ATTITUDE CONTROL ON SOLAR POWER
SYSTEMS,

(U)

MAY 64 17P FISCHELL, ROBERT E. ;
REPT. NO. CF-3077
CONTRACT: NOW62 0604C

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: (*SOLAR CELLS, ATTITUDE CONTROL SYSTEMS),
(*ATTITUDE CONTROL SYSTEMS, SOLAR CELLS), SPACECRAFT,
SATELLITES(ARTIFICIAL), POWER SUPPLIES, STABILIZATION,
ORBITS, SOLAR RADIATION, SPINNING(MOTION), GEOMAGNETISM,
GRAVITY (U)

THERE IS A STRONG RELATIONSHIP BETWEEN A
SPACECRAFT'S ATTITUDE CONTROL SYSTEM AND ITS
CAPABILITY FOR GENERATING ELECTRICAL POWER FROM SOLAR
CELLS. THE EFFECTS OF FOUR PARTICULARLY
INTERESTING PASSIVE ATTITUDE CONTROL TECHNIQUES ON
THE SPACECRAFT'S SOLAR POWER SYSTEM ARE DISCUSSED.
THESE FOUR TECHNIQUES ARE: SOLAR STABILIZATION,
SPIN STABILIZATION, MAGNETIC STABILIZATION, GRAVITY
GRADIENT STABILIZATION. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 625 440 10/2 18/8
NAVAL RESEARCH LAB WASHINGTON D C

RADIATION DAMAGE IN SILICON SOLAR CELLS FROM 4.6-MEV
PROTON BOMBARDMENT. (U)

DESCRIPTIVE NOTE: FINAL REPT.,
NOV 65 45P STATLER, R. L. ;
REPT. NO. NRL-6333
PROJ: SF-013-12-04-4533 ,SR-007-11-01-0549

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-608 213.

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*PROTON
BOMBARDMENT, SOLAR CELLS), (*DAMAGE, SOLAR CELLS),
ELECTRICAL PROPERTIES, PHOTOELECTRIC EFFECT,
SATELLITES(ARTIFICIAL), POWER SUPPLIES, DEGRADATION,
(U)DEGRADATION (U)

A STUDY WAS MADE OF THE RADIATION DAMAGE IN TEN
TYPES OF SILICON SOLAR CELLS AS A RESULT OF 4.6-MEV
PROTON BOMBARDMENT. THE CELLS COMPRISED SUCH TYPES
AS P/N CELLS, N/P CELLS WITH DIFFERENT BULK-
RESISTIVITIES, PLANAR CELLS, AND DRIFT-FIELD CELLS.
A COMPARATIVE ANALYSIS WAS MADE OF THE RADIATION-
INDUCED DEGRADATION IN THESE CELLS AS A FUNCTION OF
SHORT-CIRCUIT CURRENT, MAXIMUM POWER OUTPUT,
MINORITY-CARRIER DIFFUSION LENGTH, AND PHOTOVOLTAIC
SPECTRAL RESPONSE. THE P/N CELLS WERE FOUND TO BE
MORE SENSITIVE TO RADIATION DAMAGE THAN ANY TYPE OF
N/P CELL IN THIS STUDY. IN THE N/P CELLS, THERE IS
A DEFINITE TREND TOWARD INCREASING RADIATION
RESISTANCE ACCOMPANYING INCREASING VALUES OF BULK
RESISTIVITY, UP TO 10 OHM-CM. THE DRIFT-FIELD SOLAR
CELLS EXHIBIT A FURTHER IMPROVEMENT IN RADIATION
RESISTANCE BEYOND THAT OF THE OTHER TYPES OF N/P
CELLS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 634 810 10/2
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

SILICON SOLAR BATTERIES, (U)

JAN 66 84P GLIBERMAN, A. YA. ; ZAYTSEVA, A.
K. ;
REPT. NO. FTD-MT-64-204,
MONITOR: TT 66-61584

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF MONO. KREMNIIEVYE
SOLNECHNYE BATAREI, MOSCOW/LENINGRAD, 1961, 72P.
MASSOVAYA RADIO BIBLIOTEKA (USSR), V396 72P 1961.

DESCRIPTORS: (SOLAR CELLS, SILICON), USSR, ENERGY
CONVERSION, PHOTOELECTRIC CELLS(SEMICONDUCTOR),
PHOTOELECTRIC EFFECT, ABSORPTION, EFFECTIVENESS,
IMPURITIES, ELECTRICAL CONDUCTIVITY (U)
IDENTIFIERS: ELECTRICAL CONDUCTIVITY (M)

THE PAMPHLET PRESENTS PHYSICAL PRINCIPLES OF WORK
OF SILICON SOLAR ENERGY PHOTOELECTRIC CONVERTERS.
CONSIDERED ARE ELECTRICAL AND SPECTRAL
CHARACTERISTICS OF INSTRUMENTS AND FACTORS AFFECTING
MAGNITUDE OF CONVERTER EFFICIENCY. PECULIARITIES OF
USE OF SOLAR BATTERIES ARE CHARACTERIZED. A NUMBER
OF CONSTRUCTIONS OF BATTERIES ARE DESCRIBED AND
EXAMPLES ARE GIVEN OF THEIR APPLICATION IN DIFFERENT
AREAS OF SCIENCE AND TECHNOLOGY. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 634 882 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

DENDRITIC SILICON SOLAR CELLS AND UTILIZATION
EXPERIENCE, (U)

66 26P WISE, JOSEPH ;
REPT. NO. AFAPL-CONF-66-7,
PROJ: AF-8173,
TASK: 817301,

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE IEEE AEROSPACE
CONFERENCE, SEATTLE, WASH. JUL 11-15, 1966.

DESCRIPTORS: (*SOLAR CELLS, SILICON), EPITAXIAL GROWTH,
PHOSPHORUS, DIFFUSION, COATINGS, QUARTZ,
PERFORMANCE(ENGINEERING), SOLAR PANELS, ELECTRIC POWER
PRODUCTION (U)

THE METHOD OF FABRICATION FOR DENDRITIC SILICON
SOLAR CELLS OF 30 SQ CENTIMETERS IS DESCRIBED; BOTH
CONVENTIONAL N ON P AND N ON P DRIFT-FIELD
CELLS ARE INCLUDED. THE N ON P CELLS ARE
FORMED THROUGH DIFFUSION OF PHOSPHORUS ON THE TOP
SURFACE; THE DRIFT-FIELD CELLS, THROUGH EPITAXIAL
GROWTH OF A 40-MICRON LAYER ON A SEGMENT OF DENDRITIC
SILICON WEB MATERIAL FOLLOWED BY PHOSPHOROUS
DIFFUSION, ANTI-REFLECTION COATINGS, AND INTEGRAL
QUARTZ COATINGS. EXPERIENCE IN FABRICATING THESE
CELLS AND IN UTILIZING THEM ON A FLEXIBLE ARRAY IS
SUMMARIZED AND THEIR POTENTIALS FOR LOWER WEIGHT,
LONGER LIFE, AND LOWER COST ARE ASSESSED; SPACE
PERFORMANCE ESTIMATES ALSO ARE INCLUDED. THE USE
OF THE ION IMPLANTATION JUNCTION FORMATION IN THE
FABRICATION OF HIGHLY EFFICIENT, THIN DENDRITIC
SILICON SOLAR CELLS ALSO IS OUTLINED. MEASUREMENTS
ACCOMPLISHED AT THE AIR FORCE AERO PROPULSION
LABORATORY ON THE VARIOUS CELL TYPES ARE INCLUDED.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 635 851 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

MEASUREMENT TECHNIQUES FOR SILICON SOLAR CELLS. (U)

MAY 66 18P PRYSTALOSKI, D. F. ;
REPT. NO. AFAPL-CONF-66-4,
PROJ: AF-817301,
TASK: 817301-19,

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED FOR PRESENTATION AT THE
ANNUAL POWER SOURCES CONFERENCE (20TH), ATLANTIC
CITY, NEW JERSEY, 24-26 MAY 1966.

DESCRIPTORS: (SOLAR CELLS, MEASUREMENT), SILICON,
EFFECTIVENESS, ELECTRIC POWER PRODUCTION, SIMULATORS,
SOLAR RADIATION, CORRELATION TECHNIQUES, CARBON, XENON,
TUNGSTEN, FILAMENTS, LIGHTING EQUIPMENT, ENERGY,
INTENSITY (U)

THE PROBLEM OF CORRELATING THE MEASURED RADIATION
ENERGY INTENSITY OF SEVERAL FLUX DETECTORS UNDER THE
CARBON-ARC, XENON, AND TUNGSTEN-FILAMENT LAMPS AS
SOLAR SIMULATORS IS COMPLEX. ASSOCIATED FACTORS OF
BASIC IMPORTANCE IN UNDERSTANDING THIS CORRELATION
ARE SPECTRAL CONTINUITY, STABILITY, SPECTRAL
DISTRIBUTION, AND UNIFORMITY OF INTENSITY OF THE
ARTIFICIAL LIGHT SOURCES. A PROCEDURE FOR
ESTABLISHING ACCURATE, INCIDENT RADIATION FLUX OR
INPUT ENERGY UNDER THE MENTIONED LIGHT SOURCES IS
ESSENTIAL TO INSURE AGREEMENT IN SOLAR-CELL
EFFICIENCY MEASUREMENTS. THE USE OF THIS
CORRELATION IS ILLUSTRATED IN THE REPORTING OF THE
PERFORMANCE CHARACTERISTICS OF THE WESTINGHOUSE
DENDRITIC, SILICON, STANDARD, AND DRIFT-FIELD, SOLAR-
CELL ARRAYS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 649 672 10/2 18/8
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF

AN ANALYSIS OF NON-UNIFORM PROTON IRRADIATION DAMAGE
IN SILICON SOLAR CELLS, (U)

MAR 66 10P CROWTHER, D. L. ; LODI, E.
A. ; DEPANGHER, J. ; ANDREW, A. ;

UNCLASSIFIED REPORT
AVAILABILITY: PUBLISHED IN IEEE TRANSACTIONS ON
NUCLEAR SCIENCE P37-46 OCT 1966.
SUPPLEMENTARY NOTE: REPT. ON IRRADIATION DAMAGE IN
SOLAR CELLS.

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), SILICON, PROTONS,
MATHEMATICAL MODELS, EXPERIMENTAL DATA, (U)EXPERIMENTAL
DATA (U)

EXPERIMENTAL DATA OBTAINED ON THE DEGRADATION OF
THE SHORT-CIRCUIT CURRENT IN 1-OHM-CM N/P SILICON
SOLAR CELLS IRRADIATED BY LOW-ENERGY, 0.1-3.0
MEV, PROTONS WERE ANALYZED WITH THE AID OF AN
N-LAYER SOLAR-CELL MODEL. THE RESULTS SHOW THAT
THE DAMAGE CONSTANT, $K(E \text{ SUB } P)$, RISES LESS
RAPIDLY WITH DECREASING PROTON ENERGY, $E \text{ SUB } P$,
THAN IT DOES AT HIGHER PROTON ENERGIES. THE
DERIVED DAMAGE LAW WAS ANALYTICALLY DESCRIBED. THE
REPRESENTATION WAS FOUND ADEQUATE FOR INCIDENT PROTON
ENERGIES OF 0.5, 1, AND 3 MEV AND DEFINITIVE E
 $\text{SUB } P > \text{OR} = 0.1 \text{ MEV}$. THE VALUE OF $K \text{ SUB } 0$
LISTED SHOULD BE CONSIDERED AS REPRESENTATIVE ONLY OF
THE PARTICULAR SOLAR CELLS ANALYZED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 650 114 10/2 11/3
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

INTEGRAL COVERS FOR SOLAR CELLS, (U)

MAR 67 24P WISE, J. F. ; MCCLELLAND,
J. A. ; STATLER, R. L. ;
REPT. NO. AFAPL-CONF-67-8
PROJ: AF-8173

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH NAVAL
RESEARCH LAB., WASHINGTON, D. C. PRESENTED AT
THE IEEE PHOTOVOLTAIC SPECIALISTS CONFERENCE
(6TH), COCOA BEACH, FLA., 28-30 MAR 67.

DESCRIPTORS: (•SOLAR CELLS, COATINGS),
PERFORMANCE(ENGINEERING), GLASS, QUARTZ, SPACE
ENVIRONMENTS, DAMAGE, RADIATION EFFECTS, CERAMIC
COATINGS (U)

PRESENT INTEGRAL COVER CONFIGURATIONS IN THE 1 TO 2
MIL THICKNESS RANGE CAN OPERATE SATISFACTORILY IN
SPACE FOR EXTENDED TIME PERIODS. PANEL WEIGHT
REDUCTIONS OF 40 PERCENT ARE POSSIBLE FOR ONE-YEAR
OPERATION IN SPACE WITH A DOSE EQUIVALENT TO 10 TO
THE 13TH POWER ELECTRONS PER SQUARE CENTIMETER PER
DAY BY THE USE OF 4-MIL INTEGRAL COVERS ON THIN,
DRIFT-FIELD SOLAR CELLS. A THOROUGH COST-
EFFECTIVENESS ANALYSIS OF THIS APPROACH HAS NOT BEEN
CONDUCTED TO-DATE, HOWEVER. PROPER DESIGN OF THESE
COATINGS CAN IMPROVE THE EFFICIENCY OF THE CELLS
THROUGH OPTIMUM SPECTRAL MATCH AND THUS ELIMINATES
THE REQUIREMENTS FOR ADHESIVES, COVER-SLIP LAYERS,
AND THE ASSOCIATED INTERFERENCE COATINGS REQUIRED TO
REDUCE ULTRAVIOLET-DARKENING EFFECTS ON THE
ADHESIVES. THE INTEGRAL COVERS EXHIBIT ABOUT THE
SAME DEGRADATION RATE AS THE FUSED-SILICA COVER
SLIPS. THESE COATINGS ALSO PERMIT HIGHER
TEMPERATURE OPERATION OF SOLAR CELLS FOR HANDLING AND
ANNEALING PURPOSES AS WELL AS NEAR-SUN MISSION
APPLICATIONS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 651 013 10/2
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS
LAB

SOME EFFECTS OF ELECTRON IRRADIATION AND TEMPERATURE
ON SOLAR CELL PERFORMANCE, (U)

MAY 63 21P MARTIN, J. H. STEENER, J.
W. RALPH, E. L. ;
REPT. NO. CF-3028
CONTRACT: NOW-62-0604

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PREPARED IN COOPERATION WITH
HELIOTEK DIV., TEXTRON ELECTRONICS, INC.

DESCRIPTORS: (SOLAR CELLS, ELECTRON IRRADIATION),
SILICON, SEMICONDUCTORS, CARRIERS (SEMICONDUCTORS),
PERFORMANCE (ENGINEERING), TEMPERATURE, DEGRADATION,
SPACE ENVIRONMENTS (U)

THE ANNA 18 GEODETIC SATELLITE WAS LAUNCHED
INTO A 600 NAUTICAL MILE, 50 DEGREE INCLINATION ORBIT
ON OCTOBER 31, 1962. PORTIONS OF VI CURVES OF
THE FLASHING LIGHT CIRCUIT WERE SUBSEQUENTLY
DETERMINED FROM TELEMETRY RECORDS. THESE DATA ARE
PRESENTED AS THE SOLID LINE PORTIONS OF FIGURE 1
FOR TWO DAYS AND FOR 29 DAYS AFTER LAUNCH.
EXAMINATION OF THESE CURVES INDICATES THE CHANGE IN
BOTH VOLTAGE AND CURRENT WHICH OCCUR AFTER
IRRADIATION. THE EFFECT OF TEMPERATURE IS ALSO
INDICATED. THEREFORE, A STUDY OF SOLAR CELL
PERFORMANCE AFTER IRRADIATION AND AS A FUNCTION OF
CELL TEMPERATURE WAS UNDERTAKEN. A QUANTITATIVE
ANALYSIS OF THESE EFFECTS IS PRESENTED, COMPARED WITH
EXPERIMENTAL RESULTS AND THE DESIGN CAPABILITIES OF
THESE TECHNIQUES EVALUATED. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 654 285 10/2 22/2
AEROSPACE CORP EL SEGUNDO CALIF LABS DIV

SOLAR CELL POWER SYSTEMS FOR AIR FORCE SATELLITES,

(U)

MAY 67 34P STOFEL, EDWIN J. ;
REPT. NO. TR-1001(2250-20)-7
CONTRACT: AF 04(695)-1001
MONITOR: SSD TR-67-89

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *POWER),
(*SATELLITES(ARTIFICIAL), *SOLAR PANELS), POWER
SUPPLIES, SPACEBORNE, QUALITY CONTROL, TESTS, DESIGN (U)

THE U.S. AIR FORCE HAS USED SOLAR CELL
POWER SYSTEMS ON VARIOUS TYPES OF SATELLITES. THE
CURRENT METHODS USED FOR CHOOSING THE ARRAY, THE
NUMBER OF CELLS, THEIR PLACEMENT ON THE SOLAR PANELS,
AND THE QUALITY ASSURANCE TESTS CONDUCTED ON THE
PANELS ARE DISCUSSED. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 657 155 10/2 9/1 18/8
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS
LAB

RADIATION DAMAGE TO ORBITING SOLAR CELLS AND
TRANSISTORS.

(U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
MAR 67 33P FISCHELL, R. E. ; MARTIN, J.
H. ; RADFORD, W. E. ; ALLEN, W. E. ;
REPT. NO. TG-886
CONTRACT: NOW-62-0604

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DAMAGE), (*TRANSISTORS,
DAMAGE), SPACE ENVIRONMENTS, EXPERIMENTAL DATA,
SCIENTIFIC SATELLITES, PERFORMANCE(ENGINEERING),
(U)PERFORMANCE(ENGINEERING)

(U)

IN-FLIGHT SOLAR CELL DEGRADATION STUDIES BEGAN WITH
THE LAUNCHING OF THE 1961-01 SATELLITE ON JUNE 29,
1961. SIMILAR EXPERIMENTS WERE FLOWN ON THE 1961-
ALPHA ETA AND 1961-ALPHA ETA 2 SATELLITES. DATA
OBTAINED FROM THESE SATELLITES COVER A TIME PERIOD
BOTH BEFORE AND AFTER OPERATION STARFISH ON
JULY 9, 1962. SUBSEQUENTLY SOLAR CELL AND
ELECTRONIC EXPERIMENTS WERE FLOWN ON SATELLITES 1962-
BETA ETA, ANNA I-B, 1963-38C, AND 1964-83C.
THE DATA INDICATE THAT THE DAMAGE TO SOLAR CELLS IN
A 1000 KM ORBIT DURING THE EARLY MONTHS AFTER
OPERATION STARFISH MAY NOT HAVE BEEN MOSTLY A
RESULT OF FISSION SPECTRUM ELECTRONS. ALTHOUGH
MANY ENERGETIC ELECTRONS WERE INTRODUCED INTO THE
INNER BELT, IT IS INDICATED THAT SOME HIGH ENERGY (>
4.5 MEV) PROTONS WERE REDISTRIBUTED TO ALTITUDES
INCLUDING 1000 KM. THE RESULTS OF FLIGHT
EXPERIMENTS INDICATE THAT OPTIMUM POWER-TO-WEIGHT
RATIO SOLAR ARRAYS WILL BE OBTAINED BY USE OF N-ON-
P SOLAR CELLS WITH 6 MIL GLASS COVERS.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 658 453 22/2 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

AN ANALYSIS OF LOW ORBITAL DRAG CONSTRAINTS OF ORBIT-
AND SUN-ORIENTED SOLAR-CELL ARRAYS. (U)

AUG 67 31P LAUDERBACK, PAUL W. ;
REPT. NO. AFAPL-CONF-68-2
PROJ: AF-3145

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE INTERSOCIETY
ENERGY CONVERSION ENGINEERING CONFERENCE (1967),
MIAMI BEACH, FLA., 13-17 AUG 67.

DESCRIPTORS: (SOLAR PANELS, AERODYNAMIC
CHARACTERISTICS), DRAG, ORBITS, SOLAR CELLS, WEIGHT,
ALIGNMENT (U)

A COMPARISON OF ORBIT- AND SUN-ORIENTED SOLAR-CELL-
ARRAY CONCEPTS TO PRODUCE SPACE POWER IN LOW-EARTH
ORBITS HAS BEEN CONDUCTED. RESULTS OBTAINED SHOW
THAT AERODYNAMIC DRAG PENALTIES AS LARGE AS 9100
POUNDS/KILOWATT FOR A ONE-YEAR MISSION MAY BE
ENCOUNTERED. THE CONTRIBUTION OF A DRAG MAKEUP
SYSTEM TO THE TOTAL SYSTEM SPECIFIC WEIGHT FOR AN
ORBIT- OR SUN-ORIENTED ARRAY IS NEGLIGIBLE ABOVE 250
AND 375 NAUTICAL MILES RESPECTIVELY. BELOW 185
NAUTICAL MILES AND FOR A MISSION DURATION OF ONE
YEAR, THE ORBIT-ORIENTED ARRAY CONCEPT IS MORE
DESIRABLE FROM A WEIGHT STANDPOINT. THE STUDY HAS
INCLUDED ONLY THE EFFECTS OF AERODYNAMIC DRAG. THE
DRAG MAKEUP SYSTEM CONSISTS OF PROPULSIVE DEVICES AND
STORAGE TANKS. FOR EACH CONCEPT THE TOTAL SYSTEM
INCLUDES DRAG MAKEUP, BATTERIES, AND SOLAR-CELL
ARRAY. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 661 557 20/12 10/2 20/3
CLEVITE CORP CLEVELAND OHIO

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT
IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: INTERIM REPT. 1 JUN 66-31 MAY 67,
SEP 67 94P SHIOZAWA, L. R. SULLIVAN,
GEORGE A. AUGUSTINE, FRANK I
CONTRACT: AF 33(615)-5224
PROJ: AF-7885
MONITOR: ARL 67-0190

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, CADMIUM SULFIDES), (*CADMIUM
SULFIDES, FILMS), TRANSPORT PROPERTIES,
CARRIERS(SEMICONDUCTORS), SULFIDES, COPPER COMPOUNDS,
PHOTOCONDUCTIVITY, SEMICONDUCTORS, OPTICAL PROPERTIES,
BAND THEORY OF SOLIDS, MODELS(SIMULATIONS), SINGLE
CRYSTALS, ELECTRICAL PROPERTIES (U)
IDENTIFIERS: PHOTOVOLTAIC EFFECT (U)

DURING THE FIRST YEAR OF THIS PROJECT 'MODEL
1066,' AN EXPLANATION OF THE MECHANISM RESPONSIBLE
FOR THE PHOTOVOLTAIC EFFECT IN THIN-FILM CDS
SOLAR CELLS WAS DEVELOPED. EMPHASIS HAS SINCE BEEN
PLACED ON CRITICAL EXPERIMENTS DESIGNED TO TEST THIS
MODEL, AND TO ESTABLISH CELL PARAMETERS ESSENTIAL TO
FURTHER REFINEMENT OF THE MODEL. EXPERIMENTS WHICH
HAVE BEEN CARRIED OUT INCLUDE MEASUREMENTS OF THE
THICKNESS OF THE CU₂S LAYER, EXAMINATION OF THE
GRAIN STRUCTURE OF THE CDS LAYER, MEASUREMENTS OF
OPTICAL ABSORPTION IN AND EXAMINATION OF THE
CRYSTALLOGRAPHY AND STOICHIOMETRY OF THE CU₂S
LAYER, DIFFUSION AND SOLUBILITY MEASUREMENTS FOR CU
IN CDS, AND MEASUREMENTS OF JUNCTION CAPACITANCE,
CURRENT-VOLTAGE CHARACTERISTICS AND SPECTRAL RESPONSE
OF CDS SOLAR CELLS. IN ADDITION, A UNIQUE
EVAPORATION SYSTEM HAS BEEN DEVELOPED AND IS BEING
USED SUCCESSFULLY. FINDINGS OF THESE
INVESTIGATIONS HAVE ALL BEEN IN GENERAL AGREEMENT
WITH 'MODEL 1066,' WHICH INVOLVES LIGHT ABSORPTION
BY HOLE-ELECTRON PAIR GENERATION IN THE P-TYPE
CU₂S LAYER, FOLLOWED BY DIFFUSION OF THE MINORITY
ELECTRONS INTO A COPPER-COMPENSATED DARK-INSULATING
CDS LAYER, AND COLLECTION OF THESE AT AN I-N
CDS HOMOJUNCTION. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 666 439 10/2 20/12
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

FABRICATION OF CADMIUM SULFIDE THIN FILM SOLAR CELLS
FOR SPACE VEHICLE TESTING. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 SEP 65-15 AUG 67,
DEC 67 48P NASTELIN, H. E. HIETANEN,
J. R. ISHIRLAND, F. A. ;
REPT. NO. 303280
CONTRACT: AF 33(615)-3253
PROJ: AF-7885
MONITOR: ARL 67-0282

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)),
(*SEMICONDUCTING FILMS, CADMIUM SULFIDES), (*SPACECRAFT
COMPONENTS, SOLAR CELLS), FLIGHT TESTING, EFFICIENCY,
STABILITY, DOPING, LIGHT TRANSMISSION, BALLOONS, BAND
THEORY OF SOLIDS, MANUFACTURING, COPPER COMPOUNDS,
SULFIDES (U)

FIVE SERIES OF FLIGHT PANELS FOR SATELLITE AND
BALLOON FLIGHT TESTING WERE PREPARED. PANELS AR-
1 THROUGH 6 WERE DELIVERED TO APL IN SEPTEMBER OF
1965. PANELS AR-8 THROUGH 10, OF SIMILAR
FABRICATION, WERE DELIVERED IN MARCH OF 1966.
PANELS ARX-701-1 THROUGH 4 WERE DELIVERED IN
APRIL OF 1967 FOR INCLUSION IN THE OVI-13
SATELLITE EXPERIMENT. THREE BALLOON FLIGHT
MODULES, AFAPL-CDS-1, -2, AND -3, WERE
DELIVERED TO APL IN MAY OF 1966, AND THREE
ADDITIONAL BALLOON FLIGHT MODULES, AFAPL-CDS-
005, 006, 007, WERE DELIVERED IN MAY OF 1967, BOTH
FOR JPL BALLOON FLIGHT EXPERIMENTS. WORK WAS
PERFORMED ON INCREASING THE EFFICIENCY AND STABILITY
OF CDS THIN FILM SOLAR CELLS. MOST OF THE WORK
WAS CONCERNED WITH IMPROVEMENTS IN THE FORMATION OF
THE BARRIER LAYER AND INCLUDED TREATMENTS OF THE
CDS FILM PRIOR TO THE FORMATION OF THE BARRIER
LAYER, VARIATIONS IN THE BARRIER FORMATION PROCESS,
AND TREATMENTS OF THE FILM AND BARRIER AFTER
FORMATION OF THE BARRIER. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 667 519 10/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

PRESENT STATUS OF CADMIUM SULFIDE THIN FILM SOLAR
CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL NOTE,
DEC 67 40P STANLEY, A. G. ;
REPT. NO. TN-1967-52
CONTRACT: AF 19(628)-5167
PROJ: AF-649L
MONITOR: ESD TR-67-574

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, CADMIUM SULFIDES), FILMS,
ELECTRICAL PROPERTIES, DEGRADATION, THERMAL PROPERTIES,
INFRARED SPECTROSCOPY, STRESSES, FAILURE(MECHANICS),
CHARGED PARTICLES, ULTRAVIOLET SPECTRA, VISIBLE SPECTRA,
CONDUCTIVITY, TENSILE PROPERTIES, MEASUREMENT (U)
IDENTIFIERS: THIN FILMS (U)

CADMIUM SULFIDE THIN FILM SOLAR CELLS, ESPECIALLY
SELECTED FOR STABILITY UNDER AMBIENT CONDITIONS,
EXPERIENCED SEVERE DEGRADATION IN THEIR I-V
CHARACTERISTICS WHEN SUBJECTED TO THERMAL CYCLING IN
VACUUM. A NUMBER OF DIAGNOSTIC TECHNIQUES WERE
APPLIED TO DETERMINE THE FAILURE MECHANISM. THESE
INCLUDED CROSS-SECTIONING, INFRARED MEASUREMENTS,
MECHANICAL STRESS TESTS AND THE MEASUREMENT OF SERIES
AND SHUNT RESISTANCE. DIFFERENT TYPES OF FAILURE
MODES ARE DISCUSSED. THE RESULTS OF RADIATION
EXPERIMENTS ARE SUMMARIZED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 668 144 10/2 22/2 18/5
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS
LAB

SOLAR CELL POWER SYSTEMS FOR APL SATELLITES. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
FEB 68 33P FISCHELL, ROBERT E. ;
REPT. NO. APL-TG-950
CONTRACT: N0W-62-0604

UNCLASSIFIED REPORT

DESCRIPTORS: (*SATELLITES(ARTIFICIAL), *SOLAR CELLS),
(*ELECTRIC POWER PRODUCTION, SATELLITES(ARTIFICIAL)),
POWER SUPPLIES, PERFORMANCE(ENGINEERING),
RELIABILITY(ELECTRONICS), BATTERY COMPONENTS, ELECTRIC
BATTERIES, TEMPERATURE, VOLTAGE, NUCLEAR POWER PLANTS,
THERMOELECTRICITY, AUXILIARY POWER PLANTS, PLUTONIUM,
SEMICONDUCTOR DIODES, ATTITUDE CONTROL SYSTEMS, DC TO DC
CONVERTERS, DIAGRAMS, SOLDERING (U)
IDENTIFIERS: SNAP 3 (U)

SINCE 1959, THE APPLIED PHYSICS LABORATORY
HAS DESIGNED AND LAUNCHED 31 EARTH SATELLITES.
FROM VERY SIMPLE, LOW-POWER DESIGN IN 1959, THERE
HAVE DEVELOPED MUCH MORE SOPHISTICATED SOLAR CELL
POWER SYSTEMS THAT GENERATE HIGHER POWER LEVELS.
THIS PAPER DESCRIBES THE DEVELOPMENT OF VARIOUS
POWER SYSTEMS AND THE APPLICATION OF SEVERAL CONTROL
TECHNIQUES FOR IMPROVING SATELLITE OPERATING
PERFORMANCE AND RELIABILITY. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 676 976 10/2
AEROSPACE CORP EL SEGUNDO CALIF LAB OPERATIONS

NEUTRON DAMAGE TO SILICON SOLAR CELLS. (U)

JUN 68 SIP STOFEL, EDWIN J. STEWART,
THOMAS B. JORNELAS, JOSEPH R. J
REPT. NO. TR-0158(3250-20)-5
CONTRACT: F04655-67-C-0158
MONITOR: SAMSO TR-68-368

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), NEUTRON REACTIONS,
SILICON, CARRIERS(SEMICONDUCTORS), DIFFUSION, ELECTRICAL
PROPERTIES, (U)ELECTRICAL PROPERTIES (U)

SILICON SOLAR CELLS OF THE N/P 5 TO 10 OHM-CM TYPE
WERE IRRADIATED WITH NEUTRON FLUENCES FROM 5.2×10
TO THE NINTH POWER TO 1.5×10 TO THE 13TH POWER N/
(SQ CM) USING A TRIGA REACTOR. CURRENT-
VOLTAGE CHARACTERISTICS, SPECTRAL RESPONSE, AND
DIFFUSION LENGTH MEASUREMENTS WERE MADE AND THE
RESULTS INTERRELATED. AGREEMENT WITH THEORY IS
GOOD. DIFFUSION LENGTH DEPENDS UPON INJECTION
LEVEL IN A MANNER SIMILAR TO THAT FOR PROTON
IRRADIATION. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 678 540 20/12 10/2 20/3
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT
IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR
CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 1, 1 JUN-
31 AUG 66,
SEP 66 25P SHIOZAWA, L. R. ; SULLIVAN,
GEORGE A. ; AUGUSTINE, F. ; JOST, J. M. ;
CONTRACT: AF 33(615)-5224
PROJ: AF-3033
TASK: 303330

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY PROGRESS REPORT
NO. 2, AD-678 542.

DESCRIPTORS: (*CADMIUM SULFIDES, *SEMICONDUCTING FILMS),
(*SOLAR CELLS, CADMIUM SULFIDES), DIFFUSION, COPPER,
COPPER COMPOUNDS, VACUUM APPARATUS, FILMS, LABORATORY
EQUIPMENT, VOLTAGE (U)
IDENTIFIERS: COPPER SULFIDE, PHOTOVOLTAIC EFFECT (U)

EMPHASIS IN THIS REPORT WAS PLACED ON THE PLANNING
AND INITIATION OF SEVERAL EXPERIMENTS DESIGNED TO
LEAD TO AN UNDERSTANDING OF THE PHOTOVOLTAIC
MECHANISM OPERATIVE IN CDS SOLAR CELLS WHICH HAVE
BEEN DEVELOPED IN THIS LABORATORY. EXPERIMENTS
INCLUDE MEASUREMENTS OF THE DIFFUSION AND SOLUBILITY
OF COPPER IN CDS CRYSTALS, AND A MEASUREMENT OF
THE THICKNESS OF THE CU₂S LAYER IN TYPICAL SOLAR
CELLS. ALSO MENTIONED IS WORK ON THE CONSTRUCTION
OF A VACUUM EVAPORATION SYSTEM AND THE DEVELOPMENT OF
OHMIC CONTACTS TO CDS CRYSTALS, BOTH OF WHICH ARE
ESSENTIAL TO THIS RESEARCH PROGRAM. (AUTHOR) (U)

UNCLASSIFIED

DOC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 678 541 20/12 10/2 20/3
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT
IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR
CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 3, 1 DEC
66-28 FEB 67,
MAR 67 30P SHIOZAWA, L. R. SULLIVAN,
GEORGE A. AUGUSTINE, FRANK ;
CONTRACT: AF 33(615)-5224
PROJ: AF-3033
TASK: 303330

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AD-678 542.

DESCRIPTORS: (*SOLAR CELLS, CADMIUM SULFIDES), (*CADMIUM
SULFIDES, SEMICONDUCTING FILMS), VACUUM APPARATUS,
REFRACTIVE INDEX, ABSORPTION SPECTRA, COPPER COMPOUNDS,
SULFIDES, DIFFUSION, VAPOR PLATING (U)
IDENTIFIERS: COPPER SULFIDES, *PHOTOVOLTAIC
EFFECT (U)

THE EMPHASIS DURING THE THIRD QUARTER WAS
PLACED ON A CONTINUATION OF EXPERIMENTS NECESSARY TO
THE UNDERSTANDING OF THE THIN FILM CDS SOLAR
CELL. INCLUDED WERE DIFFUSION AND SOLUBILITY
MEASUREMENTS OF COPPER IN CDS, PERFECTION OF A
NEW VACUUM EVAPORATION SYSTEM, AND MEASUREMENTS OF
THE INDEX OF REFRACTION AND ABSORPTION COEFFICIENTS
OF EVAPORATED THIN CU₂S FILMS AS A FUNCTION OF
WAVELENGTH. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 678 542 20/12 10/2 20/3
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT
IN HIGH-EFFICIENCY CDS THIN-FILM SOLAR
CELLS. (U)

DESCRIPTIVE NOTE: QUARTERLY PROGRESS REPT. NO. 2, 1 SEP-
30 NOV 66,

DEC 66 37P SHIOZAWA, L. R. ; SULLIVAN,

GEORGE A. ; AUGUSTINE, F. ; JOST, J. M. ;

CONTRACT: AF 33(615)-5224

PROJ: AF-3033

TASK: 303330

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY PROGRESS REPORT
NO. 1, AD-678 540.

DESCRIPTORS: (*CADMIUM SULFIDES, *SEMICONDUCTING FILMS),
(*SOLAR CELLS, CADMIUM SULFIDES),
CARRIERS(SEMICONDUCTORS), DIFFUSION, COPPER, COPPER
COMPOUNDS, SULFIDES, VACUUM APPARATUS, FILMS, VOLTAGE,
EFFICIENCY (U)

IDENTIFIERS: COPPER SULFIDE, PHOTOVOLTAIC EFFECT,
QUANTUM EFFICIENCY (U)

THIS REPORT GIVES A TENTATIVE EXPLANATION OF THE
MECHANISM RESPONSIBLE FOR THE PHOTOVOLTAIC EFFECT IN
THE THIN-FILM CDS CELLS, AND A DISCUSSION OF
CRITICAL EXPERIMENTS WHICH MIGHT BE PERFORMED TO TEST
THIS MODEL. ALSO REPORTED IS THE CONTINUATION OF
THE WORK ON THE DIFFUSION OF COPPER INTO CDS
SINGLE CRYSTALS, AND THIS HAS BEEN EXTENDED TO
INCLUDE DIFFUSION OF CU IN THE CDS SOLAR CELLS.
A NEW VACUUM EVAPORATION SYSTEM FOR THE PROJECT HAS
BEEN INSTALLED AND IS NOW OPERATIONAL. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 682 888 22/2 21/3 10/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

THE ION ENGINE AND LARGE SOLAR ARRAY FOR THE XS
SPACECRAFT.

(U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
AUG 68 28P DAY, B. P. TREBLE, F. C.

REPT. NO. RAE-YR-68191

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE ANNUAL MEETING OF
THE BRITISH INTERPLANETARY SOCIETY (NO. 1),
SOUTHAMPTON UNIV., 24-25 APR 68.

DESCRIPTORS: (*SOLAR PANELS, DESIGN), (*SPACECRAFT
COMPONENTS, RELIABILITY(ELECTRONICS)), (*ION ENGINES,
DESIGN), ION ENGINES, SPACE PROPULSION, SOLAR PANELS,
DESIGN, SOLAR CELLS, SUBSTRATES, GREAT BRITAIN,
SYNCHRONOUS SATELLITES

(U)

IDENTIFIERS: BLACK ARROW LAUNCH VEHICLES

(U)

A DESCRIPTION IS GIVEN OF THE ION ENGINE AND THE
550 W DEPLOYABLE SOLAR ARRAY PROPOSED FOR THE
BLACK ARROW XS SPACECRAFT. PROBLEM AREAS ARE
DISCUSSED AND AN INDICATION IS GIVEN OF THE PRESENT
STATE OF DEVELOPMENT. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 684 560 10/2

CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT. 1 NOV 67-1
NOV 68:

DEC 68 45P NASTELIN, H. E. :

CONTRACT: F33615-68-C-1182

PROJ: AF-7885

MONITOR: ARL 68-0217

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR CELLS, CADMIUM COMPOUNDS), FILMS,
SOLAR PANELS, BARRIER COATINGS, CIRCUIT
INTERCONNECTIONS, MANUFACTURING, EFFICIENCY, ARSENIDE (U)
IDENTIFIERS: THIN FILMS (U)

THE PERFORMANCE OF TWO CDS THIN FILM SOLAR CELL
FLIGHT PANELS, WHICH WERE INCLUDED IN A SATELLITE
EXPERIMENT IN A HIGH RADIATION ORBIT, SHOWED NO
SERIOUS DEGRADATION AFTER A PERIOD OF 130 DAYS.
THE RESULTS OF BALLOON FLIGHT CALIBRATION TESTS
INDICATE THAT THE PERFORMANCE OF CDS THIN FILM
SOLAR CELLS AT 80,000 FEET VERY CLOSELY PARALLELS
SIMULATED AND MEASUREMENTS. THE EVALUATION OF A
NUMBER OF MATERIALS AS CONTACTS TO THE BARRIER LAYER
OF THE CDS CELL INDICATES THAT GOLD, EITHER
EVAPORATED OR AS THE FILLER IN A CONDUCTIVE EPOXY
SUCH AS IS PRESENTLY USED IN THE FABRICATION PROCESS
OF CDS CELLS, PROVIDES THE LOWEST RESISTANT OHMIC
CONTACT. A STUDY IN THE OPTIMIZATION OF THE
BARRIER FORMATION PROCESS SHOWS THAT A FAIRLY WIDE
LATITUDE EXISTS IN THE VARIOUS PROCESS PARAMETERS,
ESPECIALLY AS REGARDS LOW LIGHT LEVEL PERFORMANCE.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 686 496 10/2 20/12
GENERAL DYNAMICS/ASTRONAUTICS SAN DIEGO CALIF

PHOTOVOLTAIC AND THERMOELECTRIC SOLAR ENERGY
CONVERSION USING THIN FILMS, (U)

DEC 61 65P ZIMMERMAN, W. B. ; EVANS, J.
C. , JR;
REPT. NO. GDA-ERR-AN-103

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR CELLS, FILMS), PHOTOELECTRIC
EFFECT, SEEBECK EFFECT, SILICON, SEMICONDUCTORS, BAND
THEORY OF SOLIDS, CADMIUM SULFIDES, DEPOSITION (U)
IDENTIFIERS: THIN FILMS (U)

SOLAR ENERGY CONVERSION BY THE USE OF THIN FILMS IN
PHOTOVOLTAIC AND THERMOELECTRIC DEVICES IS DISCUSSED.
EXPERIMENTAL WORK IS PRESENTED ON THE FABRICATION
OF A THIN FILM CADMIUM SULFIDE CELL WHICH UTILIZES
THE PHOTOVOLTAIC EFFECT. A THEORETICAL
INVESTIGATION IS MADE OF THE TEMPERATURE DIFFERENCES
OBTAINABLE IN SPACE BY USING THIN, LIGHT-WEIGHT
PLASTIC SHEETS, AND THE USE OF SUCH PLASTICS FOR
THERMOELECTRIC GENERATORS IS DISCUSSED.
TEMPERATURE DIFFERENCES OF SEVERAL HUNDRED
CENTRIGRADE DEGREES CAN BE OBTAINED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 691 506 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

ENVIRONMENTAL ASSESSMENT OF THIN SILICON SOLAR CELLS
FROM PILOT PRODUCTION. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JAN 69 42P CRABB, R. L. ;
REPT. NO. RAE-TR-69006

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, SOLAR CELLS), (*SOLAR
CELLS, RELIABILITY(ELECTRONICS)), SILICON, SPACE
ENVIRONMENTS, DAMAGE, RADIATION EFFECTS, ELECTRONS,
PROTONS, MANUFACTURING, PROTECTIVE TREATMENTS, METAL
COATINGS, ELECTRIC TERMINALS, CORROSION INHIBITION,
PERFORMANCE(ENGINEERING), STORAGE, HUMIDITY, THERMAL
STABILITY, LIQUID IMMERSION TESTS, FAILURE(ELECTRONICS);
GREAT BRITAIN (U)
IDENTIFIERS: EVALUATION (U)

FOLLOWING THE EARLIER DEMONSTRATION OF THE
PERFORMANCE CAPABILITIES OF 4 MIL SILICON SOLAR CELLS
AND THE FEASIBILITY OF USING THESE CELLS ON LARGE
FLEXIBLE ARRAYS OF SPACE VEHICLES, MORE THAN A
THOUSAND 4 MIL CELLS HAVE BEEN FABRICATED IN PILOT
PRODUCTION BY FOUR ROUTES. THE VARIOUS TYPES OF
CELLS WHICH HAVE BEEN EVALUATED HAD SOLDERLESS
EVAPORATED TITANIUM-SILVER CONTACTS IN BOTH A
CONVENTIONAL AND WRAP-ROUND CONFIGURATION, SOLDERLESS
EVAPORATED TITANIUM-SILVER CONTACTS 'OVER-PLATED'
WITH A LAYER OF COPPER-GOLD, AND SOLDERLESS PLATED
NICKEL-COPPER-GOLD CONTACTS IN A CONVENTIONAL AND
WRAP-ROUND CONFIGURATION. BOTH 1 X 2 AND 2 X 2 CM,
N ON P CELLS HAVE BEEN MANUFACTURED FROM 1 AND 10 OHM
CM BORON DOPED SILICON. IN EVERY CASE,
SATISFACTORY PRODUCTION YIELDS HAVE BEEN ACHIEVED.
THE ABOVE CELLS HAVE BEEN SUBJECTED TO
ENVIRONMENTAL CONDITIONS AIMED AT STUDYING THE
EFFECTS OF HIGH AMBIENT HUMIDITY ON THE CELL CONTACTS
DURING 'SHELF-LIFE' PRIOR TO LAUNCH AND THE
DEGRADATION IN PERFORMANCE FROM ELECTRON AND PROTON
IRRADIATION ENCOUNTERED DURING LONG TERM SPIRAL
TRANSFER ORBITS TO SYNCHRONOUS ALTITUDE.
SPECIFICALLY THE PROBLEM OF LOW ENERGY 'SYNCHRONOUS
ALTITUDE' PROTON IRRADIATION OF EXPOSED BAR AND BACK
CONTACTS AND THE PROTECTION AFFORDED BY VARIOUS FORMS
OF COATINGS HAS BEEN INVESTIGATED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 691 587 10/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

LARGE SOLAR ARRAY DEVELOPMENT IN U. K. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JAN 69 26P TREBLE, F. C. ;
REPT. NO. RAE-TR-69007

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE IEEE PHOTOVOLTAIC
SPECIALISTS' CONFERENCE (7TH), PASADENA, CALIF.
19-21 NOV 68.

DESCRIPTORS: (*EXTENDABLE STRUCTURES, SOLAR PANELS),
(*SOLAR PANELS, DESIGN), SOLAR CELLS, SILICON, FLEXIBLE
STRUCTURES, THERMOPLASTIC RESINS, FILMS, SUBSTRATES,
SUPPORTS, STORAGE, OPERATION, PNEUMATIC DEVICES,
PYROTECHNICS, IMPACT SHOCK, VIBRATION, ISOLATORS, CIRCUIT
INTERCONNECTIONS, THERMAL EXPANSION, WEIGHT, GREAT
BRITAIN (U)
IDENTIFIERS: MOUNTINGS, POLYIMIDE RESINS (U)

ASPECTS OF LARGE SOLAR ARRAY TECHNOLOGY ARE
REVIEWED, WITH PARTICULAR REFERENCE TO THE
DEVELOPMENT OF AN EXPERIMENTAL 560 W DEPLOYABLE
ARRAY, WHICH HAS SOME NOVEL FEATURES. THE ARRAY
CONSISTS OF VERY THIN SILICON SOLAR CELLS MOUNTED ON
KAPTON POLYIMIDE FILM. IT IS STOWED BY FOLDING
THE KAPTON CONCERTINA FASHION INTO RECTANGULAR
COMPARTMENTS AND DEPLOYED BY PNEUMATICALLY-ACTUATED
TELESCOPIC MASTS. DEPLOYMENT IS INITIATED BY
DUPLICATED PYROTECHNIC ACTUATORS AND TAKES ABOUT TWO
MINUTES TO COMPLETE. THE ESTIMATED ALL-UP WEIGHT
OF THE 78 SQ FT ARRAY, INCLUDING STOWAGE
COMPARTMENTS, CUSHIONING AND DEPLOYMENT MECHANISM IS
25.2 LB, GIVING A POWER-WEIGHT RATIO OF 22.3 W/LB
AT 55C. THE MAIN PROBLEM AREAS ARE DISCUSSED IN
SOME DETAIL, WITH AN INDICATION OF THE PROGRESS MADE
TO DATE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 691 631 10/2 18/6 20/12
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

A STUDY OF AMERICAN RADIATION RESISTANT 'LITHIUM'
SOLAR CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 69 17P CRABB, R. L. ;
REPT. NO. RAE-TR-69044

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), LITHIUM, DOPING,
SILICON, GREAT BRITAIN, (U)GREAT BRITAIN (U)

THE PERFORMANCE CHARACTERISTICS OF TWENTY-FIVE
AMERICAN LITHIUM-DOPED P ON N SILICON SOLAR CELLS
HAVE BEEN EVALUATED FOLLOWING SEQUENTIAL 1 MEV
ELECTRON IRRADIATION FOR FLUENCES UP TO 10 TO THE
16TH POWER/E.SQ.CM. ALTHOUGH THE 'SELF HEALING'
PERFORMANCE RECOVERY EXHIBITED BY THESE CELLS AT ROOM
TEMPERATURE FOLLOWING ELECTRON IRRADIATION WAS
IMPRESSIVE, THEIR N-TYPE BASE SILICON SUSTAINED MUCH
GREATER DAMAGE THAN THE P-TYPE BASE SILICON OF THE N
ON P, 10 OHM-CM CONTROL CELLS. THUS THE END-OF-
LIFE PERFORMANCE WAS, AT BEST, WORSE THAN THAT OF
CONVENTIONAL N ON P, 10 OHM-CM CELLS. THE POST-
IRRADIATION PERFORMANCE OF THE LITHIUM CELLS HAS
REMAINED UNCHANGED FOR THREE THOUSAND HOURS.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 694 117 10/2 20/12
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

CALCULATED EFFICIENCIES OF PRACTICAL GAAS AND
SI SOLAR CELLS INCLUDING THE EFFECT OF BUILT-IN
ELECTRIC FIELDS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
NOV 68 48P ELLIS, R. ; MOSS, T. S. ;
REPT. NO. RAE-YR-68268

UNCLASSIFIED REPORT

DESCRIPTORS: (*SEMICONDUCTOR DEVICES, SOLAR CELLS),
(*SOLAR CELLS, PERFORMANCE(ENGINEERING)), GALLIUM
ARSENIDES, SILICON, RELIABILITY(ELECTRONICS), DOPING,
ELECTRIC FIELDS, DAMAGE, RADIATION EFFECTS,
RECOMBINATION REACTIONS, CARRIERS(SEMICONDUCTORS),
DEPOSITION, MANUFACTURING, EFFICIENCY, GREAT BRITAIN (U)
IDENTIFIERS: *SEMICONDUCTOR JUNCTIONS (U)

THE PERFORMANCE OF GAAS SOLAR CELLS HAS BEEN
CALCULATED AS A FUNCTION OF THE DOPING LEVELS, USING
PRACTICAL VALUES FOR THE TRANSPORT PARAMETERS.
CALCULATIONS SHOW THAT SURFACE RECOMBINATION IS A
MORE PROBABLE CAUSE OF THE POOR EFFICIENCIES OBTAINED
IN PRACTICE THAN RECOMBINATION IN THE JUNCTION
REGION. ELECTRIC FIELDS BUILT INTO THE CELL BY
DOPING GRADATIONS MAY BE USED TO REDUCE SURFACE
LOSSES AND PRODUCE AN EFFICIENCY EXCEEDING 20% FOR
A SURFACE RECOMBINATION VELOCITY OF 10 TO THE 6TH
POWER CM/SEC. THIS FIGURE ALLOWS FOR THE FINITE
RESISTANCE OF THE SURFACE LAYER, THE EFFECT OF WHICH
IS CONSIDERED IN DETAIL FOR SEVERAL CASES. RESULTS
FOR SI CELLS ARE ALSO PRESENTED. THESE ARE WELL
IN ACCORD WITH THE VALUES OBTAINED IN PRACTICE.
FOR BOTH MATERIALS CONSIDERATION IS GIVEN TO THE
DEGRADATION BROUGHT ABOUT BY PARTICLE COMBARDMENT.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 694 893 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

PERFORMANCE OF CADMIUM SULFIDE THIN FILM SOLAR CELLS
IN A SPACE ENVIRONMENT. (U)

DESCRIPTIVE NOTE: JOURNAL ARTICLE,
DEC 68 4P STANLEY, ALAN G. ;
REPT. NO. JA-3359
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-69-196

UNCLASSIFIED REPORT

AVAILABILITY: PUB. IN PROCEEDINGS OF THE INSTITUTE
OF ELECTRICAL AND ELECTRONICS ENGINEERS, V57 N4 P692-
694 APR 69.

SUPPLEMENTARY NOTE: REVISION OF REPORT DATED 30 OCT
68.

DESCRIPTORS: (*SATELLITES(ARTIFICIAL), SOLAR PANELS),
(*CADMIUM SULFIDES, SOLAR CELLS), (*SOLAR CELLS,
RELIABILITY(ELECTRONICS)), FILMS, SPACE ENVIRONMENTS,
THERMAL STABILITY, ELECTRICAL PROPERTIES, DEGRADATION(U)
IDENTIFIERS: EVALUATION, THIN FILMS (U)

CADMIUM SULFIDE THIN FILM SOLAR CELLS HAVE BEEN
SUBJECTED TO EXTENDED THERMAL CYCLING TESTS IN VACUUM
TO SIMULATE THE CONDITIONS OF AN EARTH ORBITING
SATELLITE. WHEN CYCLED UNDER LOAD, THE SOLAR CELLS
EXHIBIT A SLOW LOSS OF OUTPUT. SEVERAL POSSIBLE
CAUSES OF THIS LOSS ARE SUGGESTED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 696 850 10/2 20/6
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

ON THE INFRA-RED RESPONSE OF SILICON SOLAR CELLS
AS A FUNCTION OF THICKNESS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUN 69 32P JENKINS, R. M. ;
REPT. NO. RAE-TR-69126, RAE-TR-SPACE-319

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, SILICON), (*INFRARED
SPECTRA, RESPONSE), SUBSTRATES, SOLAR RADIATION,
ABSORPTION, PROBABILITY, MATHEMATICAL MODELS, GREAT
BRITAIN (U)
IDENTIFIERS: SPECTRA (U)

THE PERFORMANCE OF THIN SOLAR CELLS IS COMPARED
WITH THAT OF CONVENTIONAL THICK CELLS AND THE FACTORS
AFFECTING THE RESPONSE AS A FUNCTION OF THICKNESS
DISCUSSED. BY USING A SIMPLE ONE-DIMENSIONAL
MODEL, EQUATIONS ARE DERIVED FOR THE CONTRIBUTION TO
THE RESPONSE OF A SOLAR CELL FROM THE BASE REGION.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 697 902 10/2 22/2
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS
LAB

DESIGN AND ANALYSIS OF SOLAR CELL ARRAY
CONFIGURATIONS FOR VERTICALLY STABILIZED SATELLITES
IN NEAR-EARTH ORBITS. (U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
AUG 69 156P ALLEN, WALTER E. ;
REPT. NO. APL-TG-1066
CONTRACT: NOW-62-0604

UNCLASSIFIED REPORT

DESCRIPTORS: (*SATELLITES(ARTIFICIAL), POWER EQUIPMENT),
(*SOLAR PANELS, CONFIGURATION), SOLAR CELLS, DESIGN,
SATELLITE ATTITUDE, LOW ORBIT TRAJECTORIES, STORAGE
BATTERIES, RELIABILITY(ELECTRONICS), SPACE ENVIRONMENTS,
DAMAGE, RADIATION EFFECTS, SOLAR RADIATION,
ILLUMINATION, STABILIZATION SYSTEMS, CELESTIAL
MECHANICS, ALBEDO, PERFORMANCE(ENGINEERING),
SPACECRAFT (U)

IDENTIFIERS: EVALUATION, NICKEL CADMIUM BATTERIES,
SHADOWS, *ARRAYS, *SOLAR CELLS, *SPACECRAFT ELECTRIC
POWER UNITS, VERTICALLY STABILIZED SATELLITES (U)

SOLAR ARRAY CONFIGURATION DESIGN AND ANALYSIS
TECHNIQUES ARE DEVELOPED FROM BASIC SOLAR CELL
PERFORMANCE CHARACTERISTICS. THE RELATIONSHIP
BETWEEN THE ARRAY AND OTHER ELEMENTS IN THE POWER
SYSTEM IS PRESENTED WITH EMPHASIS ON NICKEL-CADMIUM
BATTERY CHARACTERISTICS AS THEY RELATE TO THE DESIGN
OF THE ARRAY. THE PREDICTABLE SOLAR ORIENTATION
PATTERNS FOR TWO AND THREE AXIS VERTICALLY STABILIZED
SPACECRAFT ARE EXAMINED IN DETAIL. THE INFLUENCE
OF THE ORBIT UPON THE DESIGN OF THE ARRAY AND METHODS
FOR PREDICTING SUNLIGHT EXPOSURE TIME AND INTEGRATED
AVERAGE ARRAY POWER ARE INTRODUCED. THE EFFECTS OF
THE ORBIT ENVIRONMENT UPON ARRAY PERFORMANCE
INCLUDING VARIATIONS IN SOLAR ILLUMINATION INTENSITY,
DEGRADATION CAUSED BY PARTICLE IRRADIATION, AND THE
POTENTIAL INFLUENCE OF EARTH ALBEDO ARE DISCUSSED.
FINALLY, A SPECIFIC ARRAY DESIGN IS UNDERTAKEN FOR
A VERTICALLY STABILIZED SPACECRAFT WITH A CONSTANT
20-WATT ELECTRICAL LOAD. THE DESIGN, ALTHOUGH
SPECIFIC, DEMONSTRATES SOLAR-ARRAY DESIGN PRINCIPLES
AND TECHNIQUES THAT ARE UNIVERSALLY APPLICABLE.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 698 927 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

TYPE APPROVAL TEST REPORT ON FERRANTI SOLAR CELLS
FOR THE BLACK ARROW X3 SPACECRAFT. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
MAR 69 22P DOLLERY, A. A. ;
REPT. NO. RAE-TR-69046

UNCLASSIFIED REPORT

DESCRIPTORS: (*SCIENTIFIC SATELLITES, SOLAR CELLS),
(*SOLAR CELLS, RELIABILITY(ELECTRONICS)), PHOTODIODES,
ACCEPTABILITY, ELECTRICAL PROPERTIES, OPTICAL
PROPERTIES, RESPONSE, DAMAGE, RADIATION EFFECTS, THERMAL
STABILITY, VISUAL INSPECTION, ELECTRIC TERMINALS,
SOLDERING, OPTICAL COATINGS, GREAT BRITAIN (U)
IDENTIFIERS: BLACK ARROW X3 SATELLITES (U)

THE REPORT PRESENTS THE RESULTS OF TYPE APPROVAL
TESTS PERFORMED ON SOLAR CELLS INTENDED FOR USE IN
THE BLACK ARROW X3 SPACECRAFT. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZDM07

AD- 702 095 20/12 20/3 10/2
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

RESEARCH ON THE MECHANISM OF THE PHOTOVOLTAIC EFFECT
IN HIGH EFFICIENCY CDS THIN-FILM SOLAR
CELLS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 JUN 66-31
MAY 69,
OCT 69 217P SHIOZAWA, L. R. (AUGUSTINE,
F. (SULLIVAN, G. A. (SMITH, J. M. , III.)
COOK, W. R. , JR;
CONTRACT: AF 33(615)-5224
PROJ: AF-7885, CLEVITE-303330
MONITOR: ARL 69-0155

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)),
(*SEMICONDUCTING FILMS, BAND THEORY OF SOLIDS), CADMIUM
SULFIDES, COPPER COMPOUNDS, SULFIDES, PHOTOCONDUCTIVITY,
EPITAXIAL GROWTH, SINGLE CRYSTALS, PHASE STUDIES,
MICROSTRUCTURE (U)
IDENTIFIERS: *PHOTOVOLTAIC EFFECT, HETEROJUNCTIONS,
COPPER SULFIDES (U)

THREE YEARS OF RESEARCH ON THE OPERATING MECHANISMS
OF THE CDS THIN-FILM SOLAR CELL ARE DESCRIBED IN
THIS REPORT. THE ESSENTIAL INFORMATION CONTAINED
IN ALL REPORTS PREVIOUSLY ISSUED UNDER THIS CONTRACT
HAS BEEN REASSEMBLED. NEW INFORMATION, NOT
PREVIOUSLY REPORTED INCLUDE DATA ON THE
ANTIMONOCROMATIC SPECTRAL RESPONSE OF DIFFERENT
TYPES OF CELLS, MEASUREMENTS OF THE THRESHOLD VOLTAGE
FOR ELECTROLYTIC DEPOSITION OF COPPER FROM CU₂S,
OBSERVATIONS ON THE FORMATION OF COPPER WHISKERS ON
CU₂S BY HEATING, X-RAY CRYSTALLOGRAPHIC DATA ON
LOW-TEMPERATURE PHASE TRANSFORMATIONS OF CUPROUS
SULFIDE, MEASUREMENTS OF OPTICAL TRANSMISSION OF
CU-SATURATED CDS SINGLE CRYSTALS, DATA ON THE
PHOTOCONDUCTIVE RISE AND DECAY TIMES OF CU-
COMPENSATED CDS, DISCUSSION OF THE BENEFICIAL
ROLE OF OXYGEN IN PROMOTING THE PHOTOVOLTAIC EFFECT
DURING CELL FABRICATION, AND THE SUBSEQUENT DEGRADING
EFFECTS OF OXYGEN DURING HIGH TEMPERATURE EXPOSURE.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 707 134 10/2 4/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

BALLOON-FLIGHT INSTRUMENTATION FOR SOLAR-CELL
MEASUREMENTS.

(U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JAN 70 22P SARLES, FREDERICK W. , JR.;
HAASE, WAYNE C. ; MCKENZIE, PAUL F. ;
REPT. NO. TR-476
CONTRACT: AF 19(628)-5167
PROJ: AF-649L
MONITOR: ESD TR-70-3

UNCLASSIFIED REPORT

DESCRIPTORS: (*METEOROLOGICAL BALLOONS, SOLAR CELLS),
(*SOLAR CELLS, DEGRADATION), CALIBRATION, SOLAR PANELS,
INSTRUMENTATION, DC TO DC CONVERTERS, TELEMETER SYSTEMS,
FIELD EFFECT TRANSISTORS, DATA TRANSMISSION SYSTEMS,
STATISTICAL DATA (U)
IDENTIFIERS: LES(LINCOLN EXPERIMENTAL SATELLITES),
LES-6 SATELLITE, LINCOLN EXPERIMENTAL SATELLITES (U)

INSTRUMENTATION WAS DEVELOPED WHICH AUTOMATICALLY
MEASURES THE V-I CHARACTERISTICS OF A NUMBER OF
SOLAR CELLS, AND TRANSMITS THE RESULTANT SERIALIZED
DATA STREAM OVER AN RF TELEMETER LINK. THE
PARTICULAR SYSTEM WAS DESIGNED FOR 64 CELLS WHOSE
SELECTION IS ACCOMPLISHED ENTIRELY BY SEMICONDUCTOR
SWITCHING. TWO-HUNDRED-AND-FIFTY-TWO POINTS ARE
TAKEN ON THE V-I CHARACTERISTIC, GIVING DETAILED
INFORMATION ON SLOPES AS WELL AS ACTUAL VALUES.
MEASUREMENT ACCURACIES ARE 0.03 PERCENT OF FULL
SCALE FOR VOLTAGE, AND 0.1 PERCENT FOR CURRENT; THESE
DO NOT REPRESENT ATTAINABLE LIMITS, BUT ARE SIMPLY
REASONABLE LIMITS FOR THIS SPECIFIC APPLICATION.
THE SYSTEM DESCRIBED WAS BUILT TO CALIBRATE SOLAR
CELLS ON A HIGH-ALTITUDE BALLOON FLIGHT, BUT THE
TECHNIQUES CAN BE USED EQUALLY WELL FOR GROUND OR
SATELLITE APPLICATIONS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 707 345 14/2 10/2
JOHNS HOPKINS UNIV SILVER SPRING MD APPLIED PHYSICS
LAB

SOLAR PANEL TEST SET.

(U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
FEB 70 29P RAY, WILLIAM E. ;
REPT. NO. APL-TG-1103
CONTRACT: NOW-62-0604
MONITOR: IDEP 556.45.00.00-56-01

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR PANELS, TEST EQUIPMENT, SUN,
SIMULATION, POWER SUPPLIES, CONTROL PANELS,
ILLUMINATION, REFLECTIVITY, CALIBRATION, TEST METHODS(U)

THE REPORT DESCRIBES THE SOLAR PANEL TEST SET DEVELOPED FOR TESTING SOLAR CELL PANELS IN ARTIFICIAL SUNLIGHT AT AN EQUIVALENT SUNLIGHT INTENSITY OF 140 MW/SQ.CM. THE TEST SET USES IODINE-QUARTZ (TUNGSTEN) LAMPS AS THE RADIANT-ENERGY SOURCE, AND THE EMERGING RADIATION IS UNIFORMLY REFLECTED AND TOTALLY DIFFUSED. AN AIR CONDITIONER, WHICH IS PART OF THE TEST SET, PROVIDES THE COOLING AIR NECESSARY TO CONTROL THE TEMPERATURE OF THE SOLAR PANEL UNDER TEST. THE METHODS OF CALIBRATING THE TEST SET ARE DESCRIBED, AND THE ACCURACY OF THE MEASUREMENTS OBTAINED WHEN USING ARTIFICIAL LIGHT AS THE RADIATION SOURCE IS DISCUSSED. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 707 483 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

PRELIMINARY RESULTS FROM THE LES-6 SOLAR CELL
EXPERIMENT. (U)

DESCRIPTIVE NOTE: MEETING SPEECH,
70 6P SARLES, FREDERICK W. ;
REPT. NO. MS-28108
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-70-119

UNCLASSIFIED REPORT

AVAILABILITY: PUB. IN AIAA PAPER NO. 70-600 P1-4
N.D.

DESCRIPTORS: (*SCIENTIFIC SATELLITES, SOLAR CELLS),
(*SOLAR CELLS, RELIABILITY), FEEDBACK AMPLIFIERS, SOLAR
PANELS, SOLAR RADIATION, PROTON BOMBARDMENT,
DEGRADATION, PERIODIC VARIATIONS, STATISTICAL DATA (U)
IDENTIFIERS: LES-6 SATELLITE (U)

IN ORDER TO STUDY SOLAR CELL DEGRADATION IN
SYNCHRONOUS ORBIT, A SOLAR CELL EXPERIMENT WAS FLOWN
ON THE LINCOLN LABORATORY LES-6 SATELLITE.
THE EXPERIMENT CONSISTS OF THIRTY CELLS OF VARIOUS
TYPES. PRELIMINARY RESULTS HAVE BEEN OBTAINED FROM
THE FIRST YEAR OF OBSERVATION. MAXIMUM POWER
DEGRADATIONS RANGE FROM 10 PER CENT FOR A CELL
COMPARABLE TO THAT IN A PROPERLY CONSTRUCTED SOLAR
ARRAY TO 35 PER CENT FOR A CELL WHICH EXPERIENCES LOW
ENERGY PROTON DAMAGE. LITHIUM DOPED P/N CELLS
FAIRED POORLY, DEGRADATIONS AS HIGH AS 42 PER CENT
BEING NOTED IN ONE UNIT. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 707 869 10/2 20/12
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS. (U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 NOV 67-1 NOV
69.

MAR 70 82P DUNN, W. F. ; NASTELIN, H.

E. ;

CONTRACT: F33615-68-C-1182

PROJ: AF-7885

MONITOR: ARL 70-0036

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)),
(*SEMICONDUCTING FILMS, ELECTRIC TERMINALS), CADMIUM
SULFIDES, SCIENTIFIC SATELLITES, BALLOONS, WORK
FUNCTIONS, COPPER COMPOUNDS, SULFIDES (U)
IDENTIFIERS: OHMIC CONTACTS, OVI-13 SATELLITE, OVI-17
SATELLITE, COPPER SULFIDES, ELECTRIC CONTACTS (U)

THE REPORT IS CONCERNED WITH TWO AREAS IN THE
CADMIUM SULFIDE SOLAR CELL DEVELOPMENT PROGRAM:
(1) A PROGRAM OF FLIGHT PANEL CONSTRUCTION FOR
SATELLITE AND BALLOON TESTING OF CDS SOLAR CELLS
AND (2) A DEVELOPMENTAL EFFORT FOR IMPROVING THE
STABILITY AND EFFICIENCY OF THE CDS SOLAR CELL.
EXPERIMENTAL CDS SOLAR CELLS PANELS ARE BEING
TESTED ON THE OVI-13 AND OVI-17 SATELLITE
EXPERIMENTS. THE DEVELOPMENTAL EFFORT WAS
CONCENTRATED INTO THE FOLLOWING AREAS: (1)
CONTACT RESISTANCE MEASUREMENTS MADE ON THE CDS
CURRENT COLLECTOR GRID ADHESIVE, (2) AN
OPTIMIZATION OF THE CDS CELL FOR GOOD LOW LIGHT
LEVEL PERFORMANCE, (3) AN OPTIMIZATION OF THE
CU₂S BARRIER FORMATION PROCESS AND (4) AN
INVESTIGATION OF COPPER NODULES FOUND ON CDS
CELLS THAT HAD BEEN DEGRADED IN THE OPEN CIRCUIT
VOLTAGE MODE. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 708 598 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

SOLAR CELL CALIBRATION EXPERIMENTS ON LES-6. (U)

DESCRIPTIVE NOTE: MEETING SPEECH,
68 8P SARLES, FREDERICK W. ;
STANLEY, ALAN G. ; BURROWES, CURTIS ;
REPT. NO. MS-2428
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-70-163

UNCLASSIFIED REPORT

AVAILABILITY: PUB. IN IEEE PHOTOVOLTAIC
SPECIALISTS CONFERENCE (7TH), PASADENA, CALIF.,
P262-266 1968.

DESCRIPTORS: (*COMMUNICATION SATELLITES(ACTIVE), SOLAR
CELLS), (*SOLAR CELLS, CALIBRATION), SPACE
COMMUNICATIONS (U)
IDENTIFIERS: LES 6 SATELLITE (U)

THE SIXTH LINCOLN LABORATORY EXPERIMENTAL
SATELLITE (LES-6) WAS PLACED IN A SYNCHRONOUS
ORBIT ON 26 SEPTEMBER 1968. AMONG INSTRUMENTATION
ON BOARD IS A SOLAR CELL CALIBRATION EXPERIMENT TO
MEASURE THE V-I CHARACTERISTICS AT VARIOUS ANGLES
OF SOLAR INCIDENCE OF 30 SOLAR CELLS INCLUDING
STANDARD N/P SILICON (SI) CELLS WITH 6-MIL COVER
SLIDES, SI N/P CELLS WITH 1-MIL SPUTTERED SILICA
COVERINGS, P/N LITHIUM DRIFTED CELLS WITH INTEGRAL
COVERS, DENDRITIC N/P SI CELLS WITH 6-MIL COVER
SLIDES AND WITH 2-MIL INTEGRAL COVERS, ION IMPLANT
SI CELLS WITH 1-MIL INTEGRAL COVERS, CDS THIN
FILM CELLS, AND CdTe THIN FILM CELLS.
CALIBRATION OF THE EXPERIMENTAL CELLS WAS CARRIED
OUT AT KITT'S PEAK NEAR TUSCON, ARIZONA.
INITIAL ORBITAL RESULTS HAVE AGREED CLOSELY WITH
THOSE EXPECTED FROM THE CALIBRATION.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 708 603 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

SOLAR CELL DEGRADATION EXPERIMENTS ON LES-4 AND -
5. (U)

DESCRIPTIVE NOTE: MEETING SPEECH,
68 6P SARLES, FREDERICK W. ; COX,
LAWRENCE P. ;
REPT. NO. MS-2427
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-70-162

UNCLASSIFIED REPORT
AVAILABILITY: PUB. IN IEEE PHOTOVOLTAIC
SPECIALISTS CONFERENCE (7TH), PASADENA, CALIF.,
P269-273 1968.

DESCRIPTORS: (*COMMUNICATION SATELLITES(ACTIVE), SOLAR
CELLS), (*SOLAR CELLS, DEGRADATION), SPACE
COMMUNICATIONS (U)
IDENTIFIERS: LES 5 SATELLITE, LES-4 SATELLITE (U)

LINCOLN LABORATORY SATELLITES LES-4 AND -5 EACH
CARRY SOLAR CELL EXPERIMENTS: MEASUREMENT OF 10
OHM CM SILICON CELL WITH 30-MIL COVER SLIDE;
MEASUREMENT OF 10 OHM CM SILICON CELL WITH 30-MIL
COVER SLIDE; MEASUREMENT OF 10 OHM CM SILICON CELL
WITH 6-MIL COVER SLIDE; MEASUREMENT OF TWO COTE
THIN FILM CELLS (LES-4 ONLY); MEASUREMENT OF TWO
CDS THIN FILM CELLS (LES-5 ONLY). RESULTS
ARE DISCUSSED. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 710 081 7/5 6/11 10/1
FRANKLIN INST RESEARCH LABS PHILADELPHIA PA

DESIGN AND DEVELOP SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 1 APR 67-31 MAR 70,
MAY 70 70P SIMPSON, WILLIAM H. ;
REUCROFT, PHILIP J. ;
REPT. NO. F1RL-F-C2022
CONTRACT: F19628-67-C-0273
PROJ: AF-8659
TASK: 865903
MONITOR: AFCRL 70-0264

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: ALSO INCLUDES PHOTOELECTRONIC
EFFECTS IN ORGANIC MATERIALS. I. CHLOROPHYLL-
CHLORANIL LAMELLAR SYSTEMS, AD-707 521, AND
PHOTOELECTRONIC EFFECTS IN ORGANIC MATERIALS. II.
VARIATION OF PHOTOVOLTAGE WITH PH IN CHLOROPHYLL-
QUINONE SOLUTIONS, AD-709 837.

DESCRIPTORS: (*CHLOROPHYLLS, *PHOTOELECTRIC EFFECT),
(*SOLAR CELLS, CHLOROPHYLLS), QUINONES,
SOLUTIONS(MIXTURES), OXYGEN, ORGANIC SOLVENTS,
EXCITONS (U)
IDENTIFIERS: MATRIX ISOLATION TECHNIQUES, CHLOROPHYLL
A, *PHOTOVOLTAIC CELLS, DISSOLVED GASES (U)

THE PHOTOVOLTAGES OF SOLUTIONS OF CHLOROPHYLL AND A
DONOR OR ACCEPTOR WERE MEASURED FOR SEVERAL SYSTEMS.
THE EFFECT OF OXYGEN DISSOLVED IN THE SOLVENT WAS
ALSO INVESTIGATED. THE PHOTOVOLTAGES WERE USUALLY
ON THE ORDER OF A FEW MILLIVOLTS. IN SOLID-LAMELLAR
SYSTEMS CONSISTING OF CHLOROPHYLL AND ORGANIC
SUBSTRATES THE PHOTOVOLTAGES WERE GENERALLY HIGHER.
AN 'ACTION' SPECTRUM INDICATED THAT THE PEAK
VOLTAGE OCCURRED AT THE PEAK ABSORPTION IN THE RED
BAND. PHOTOVOLTAGE PRODUCTION IN THE SOLID SYSTEMS
WAS ATTRIBUTED TO A BI-EXCITONIC MECHANISM. QUANTUM
MECHANICAL TUNNELING AND OTHER CONDUCTION MECHANISMS
WERE INVESTIGATED IN THIN FILMS OF CHLOROPHYLL A.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 710 636 10/2
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

THIN FILM CDS SOLAR CELL FABRICATION PARAMETER
STUDY.

(U)

DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT.,

JUN 70 17P DEUCHER, T. F. ;

CONTRACT: F33615-68-C-1182

PROJ: AF-7885

TASK: 788500

MONITOR: ARL 70-0099

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), CADMIUM
SULFIDES, METAL FILMS, SEMICONDUCTING FILMS, PLASTIC
COATINGS, VAPOR PLATING, VACUUM APPARATUS, BARRIER
COATINGS

(U)

IDENTIFIERS: THIN FILMS

(U)

THE STUDY IS, ESSENTIALLY, A BRIEF DESCRIPTION OF
THE PROCESSES, CURRENTLY USED AND ALTERNATIVES,
NECESSARY TO THE MANUFACTURE OF THIN FILM CDS
SOLAR CELLS. THESE PROCESSES RELATE TO THE
APPLICATION OF THE CONDUCTIVE LAYER TO THE PLASTIC
FILM, PLATING ON OF A SUITABLE METALLIC INTERLAYER,
DEPOSITION OF THE CDS LAYER, FORMATION OF THE
BARRIER, ATTACHMENT OF THE CONDUCTIVE GRID AND COVER
PLASTIC AND IN PROCESS AND FINAL TESTING. MATERIAL
COSTS AND PRODUCTIVITY OF EACH OF THE PRESENT
MANUFACTURING PROCESSES ARE LISTED, AND AS A
COMPARISON, MATERIAL COSTS AND PRODUCTIVITY BASED ON
HIGH PRODUCTION METHODS ARE ESTIMATED WHEREVER
POSSIBLE. THOSE PROCESSES OR OPERATIONS WHICH LEND
THEMSELVES PRESENTLY TO LARGE VOLUME PRODUCTION HAVE
BEEN INCORPORATED INTO SUGGESTED MECHANISMS THAT ARE
BRIEFLY DESCRIBED. A FEW, OF WHICH GRIDDING IS AN
EXAMPLE, ARE IN NEED OF FURTHER STUDY, AS TO
PROCESSES WHICH ARE MORE ADAPTABLE TO MECHANIZATION
THAN AT PRESENT. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 712 936 20/12 13/8 10/2
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

PROPERTIES OF P-N JUNCTIONS IN CADMIUM SULFIDE
AND CONSTRUCTION OF PHOTOELECTRIC TRANSDUCERS, (U)

JUN 70 8P KNEV, STEFAN ; STOYANOV, VASIL
; STEFANOV, RODOSLAV ;
PEPT. NO. FTD-HC-23-133-70
PROJ: FTD-7230178

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED TRANS. OF BULGARSKA
AKADEMIYA NA NAUKITE, SOFIA. FIZICHESKI INSTITUT.
IZVESTIYA, V17 P13-20 1968.

DESCRIPTORS: (*SEMICONDUCTORS, INTERFACES), (*CADMIUM
SULFIDES, PHOTOELECTRIC EFFECT), (*SOLAR CELLS,
MANUFACTURING), PERFORMANCE(ENGINEERING), USSR (U)
IDENTIFIERS: *SEMICONDUCTOR JUNCTIONS,
TRANSLATIONS (U)

THE DEVELOPMENT OF EFFICIENT PHOTOELECTRIC
CONVERTERS BASED ON CDS IS DESCRIBED. THE
PHOTOELECTRIC P-N JUNCTIONS WERE MADE AS FOLLOWS:
CADMIUM SULFIDE POWDER WAS PRESSED INTO SMALL
TABLETS UNDER A PRESSURE OF SEVERAL HUNDRED KILOGRAMS
PER CM(SUPERScript 2). THE TABLETS WERE BAKED
FOR 15 MIN UNDER CLOSELY CONTROLLED CONDITIONS TO
FORM PURE MONOCRYSTALS (SIZE, UP TO 50 MU) ON ONE
SIDE OF THE TABLET, I.E., TO FORM THE WORKING SURFACE
OF THE CONVERTER. THIS WORKING SURFACE WAS THEN
IMMERSED FOR SEVERAL SECONDS IN A BOILING, SATURATED
WATER SOLUTION OF COPPER SULFATE TO COVER IT WITH A
THIN COATING WHICH CONTAINED P-TYPE CARRIERS AND WAS
PRESUMED TO BE FORMED BY THE CHEMICAL REACTION GIVEN.
THE COATED TABLET WAS THEN HEATED AT A TEMPERATURE
OF 350 DEGREES CENTIGRADE FOR ABOUT 20 SEC. THE
CONVERTER WAS COMPLETED BY DEPOSITING ELECTRODES ON
BOTH SIDES OF THE TABLET. EFFICIENCIES OF THE ORDER
OF 8 PERCENT WERE OBTAINED WITH THE DESCRIBED
PHOTOELECTRIC CONVERTERS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 715 261 10/2 18/8
AEROSPACE CORP EL SEGUNDO CALIF LAB OPERATIONS

LOW - ENERGY PROTON DAMAGE TO SILICON/
SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: REPT. FOR JAN 69-JAN 70,
OCT 70 37P STOFEL, EDWIN J. JOSLIN,
DAVID E. ;

REPT. NO. TR-0059(6250-20)-8
CONTRACT: F04701-70-C-0059
MONITOR: SAMSO TR-70-407

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), PROTONS,
RELIABILITY(ELECTRONICS), CRYSTAL DEFECTS, SILICON,

(U)SILICON

(U)

IDENTIFIERS: ATS 1 SATELLITE

(U)

THE EFFECT OF LOW-ENERGY (<2 MEV) PROTON
IRRADIATION UPON THE JUNCTION PROPERTIES OF SILICON
SOLAR CELLS HAS BEEN MEASURED. THESE MEASUREMENTS
ARE USED TO EXPLAIN THE LARGE POWER LOSS OBSERVED ON
THE ATS-1 AND INTELSAT II-4 SATELLITES.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 715 285 10/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

DEGRADATION OF CDS THIN FILM SOLAR
CELLS IN DIFFERENT ENVIRONMENTS.

(U)

DESCRIPTIVE NOTE: TECHNICAL NOTE,
NOV 70 26P STANLEY, ALAN G. ;
REPT. NO. TN-1970-33
CONTRACT: F19628-70-C-0230
PROJ: AF-649L
MONITOR: ESD TR-70-341

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DEGRADATION), TEST METHODS,
THERMAL STRESSES, SPACE ENVIRONMENTS, CADMIUM SULFIDES,
FAILURE(ELECTRONICS), SEMICONDUCTOR DEVICES,
RELIABILITY(ELECTRONICS) (U)
IDENTIFIERS: PHOTOVOLTAIC EFFECT (U)

CADMIUM SULFIDE THIN FILM CELLS WERE OPERATED UNDER
DIFFERENT BIAS CONDITIONS FOR PERIODS OF SIX MONTHS
IN THE FOLLOWING ENVIRONMENTS: VACUUM THERMAL
CYCLING BETWEEN -160 AND 60C, CONSTANT ILLUMINATION
IN VACUUM AND IN DRY OXYGEN AT 60C. THE RESULTS
WERE COMPARED TO THE DEGRADATION OF TEST CELLS IN
SYNCHRONOUS ORBIT. IT WAS CONCLUDED FROM THE
OBSERVED CHANGES IN THE I-V CHARACTERISTICS THAT
THE DEGRADATION IS CAUSED PRIMARILY BY A COMBINATION
OF LIGHT AND TEMPERATURE AND NOT BY PURELY THERMAL
STRESSES. THE PRESENCE OF A VACUUM DOES NOT APPEAR
TO BE A SIGNIFICANT CONTRIBUTORY FACTOR TO THE
ULTIMATE DEGRADATION OF THE CELLS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 721 888 9/1 10/2
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

SPECTRAL RESPONSE INVESTIGATION OF SILICON
PHOTOVOLTAIC CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT. 1 JAN-1 DEC 69,
MAR 71 91P KITTL, EMIL ;
REPT. NO. ECOM-3401
PROJ: DA-1-T-061102-A-34-A
TASK: 1-T-061102-A-34-A-02

UNCLASSIFIED REPORT

DESCRIPTORS: (*PHOTOELECTRIC CELLS (SEMICONDUCTOR),
DESIGN), (*SOLAR CELLS, TEST METHODS), SILICON,
THERMOCOUPLES, SPECTRUM ANALYZERS, OPTICAL FILTERS,
SOLAR RADIATION (U)
IDENTIFIERS: *PHOTOVOLTAIC CELLS, *THERMOPHOTOVOLTAIC
CONVERTERS (U)

RESULTS OF AN EXPERIMENTAL ANALYSIS ARE PRESENTED WHICH ENCOMPASS MEASUREMENTS OF THE ABSOLUTE VALUE OF THE SPECTRAL RESPONSE OF SILICON PHOTOVOLTAIC CELLS OVER A WIDE RANGE OF INCIDENT MONOCHROMATIC RADIATION INTENSITY. THE CELLS, A DIFFUSED-JUNCTION, SINGLE-CRYSTAL TYPE, CONTAINED A DENSE CONTACT GRID PATTERN. THIS DESIGN PROVIDED HIGH POWER DENSITY OUTPUT AT HIGH INTENSITY RADIATION LEVELS. THREE EXPERIMENTAL APPROACHES WERE USED RANGING IN INCIDENT PHOTON CURRENT FROM 0.1 MICRO ANGSTROM/SQ CM TO 1 ANGSTROM/SQ. CM. FOR THE LOW-INTENSITY RADIATION LEVELS, THE BEAM FROM A PRISM-MONOCHROMATOR ILLUMINATED THE SILICON CELL. AT MEDIUM RADIATION LEVELS, A TUNGSTEN-IODINE STANDARD LAMP WAS COMBINED WITH TWENTY-NINE NARROW-BAND INTERFERENCE FILTERS TO PROVIDE QUASI-MONOCHROMATIC RADIATION. AT HIGH RADIATION LEVELS, A PULSED XENON DISCHARGE LAMP WAS USED WITH THE SAME SET OF INTERFERENCE FILTERS. A BROADBAND, THERMOCOUPLE RADIATION DETECTOR PROVIDED FOR THE SIMULTANEOUS MEASUREMENT OF THE INCIDENT RADIATION AND THE SILICON-CELL OUTPUT CURRENT. MEASUREMENT OF EFFECTIVE CARRIER LIFETIME SERVED AS A MEANS FOR EXPLAINING DIFFERENCES IN THE SPECTRAL RESPONSE BEHAVIOR BETWEEN THE P+/N AND N+/P CELL TYPES. RESULTS FROM EXPERIMENTS WITH HIGH-INTENSITY CHROMATIC LIGHT SOURCES ARE ALSO REPORTED WHICH INDICATE THE HIGH OUTPUT POWER POTENTIAL OF THE SILICON CELL. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 722 112 10/2 20/12
CLEVITE CORP CLEVELAND OHIO

RESEARCH ON THE OPERATING AND FAILURE
MECHANISMS IN CDS SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 JUN 69-31
MAY 70,

SEP 70 147P SHIOZAWA, L. R. ; AUGUSTINE,
F. ; COOK, W. R. , JR;
CONTRACT: F33615-69-C-1732
PROJ: AF-7885, AF-916080/7885
MONITOR: ARL 70-0169

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, FAILURE(ELECTRONICS)),
(*SEMICONDUCTING FILMS, ELECTRICAL PROPERTIES), CADMIUM
SULFIDES, COPPER COMPOUNDS, ELECTRIC CURRENTS,
MANUFACTURING, VAPOR PLATING, PHASE STUDIES, PHASE
DIAGRAMS (U)
IDENTIFIERS: THIN FILMS, COPPER SULFIDES (U)

THE OPERATING AND FAILURE MECHANISMS OF CU₂S:
CDS THIN FILM SOLAR CELLS WERE EXAMINED FURTHER
DURING THE PAST YEAR. THE SHORT CIRCUIT CURRENT OF
PILOT PRODUCTION CELLS WAS FOUND TO BE SENSITIVE TO
THE UNIFORMITY OF ZN PLATING AND TO THE TEXTURE OF
THE METALLIZED PLASTIC SUBSTRATE. EXTENSIVE
LITERATURE AND EXPERIMENTAL STUDIES ON THE VARIOUS
FORMS OF CUPROUS SULFIDE WERE CARRIED OUT.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 723 315 10/2
CLEVITE CORP CLEVELAND OHIO ELECTRONIC RESEARCH DIV

IMPROVEMENTS IN CDS THIN FILM SOLAR
CELLS.

(U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 NOV 69-31
OCT 70;

JAN 71 81P DUNN, WILLIAM F. ;
CONTRACT: F33615-68-C-1162
PROJ: AF-7885
MONITOR: ARL 71-0015

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)),
SEMICONDUCTOR DEVICES, CADMIUM SULFIDES, FLIGHT TESTING,
SCIENTIFIC SATELLITES (U)
IDENTIFIERS: OVI-13 SATELLITE, OVI-17 SATELLITE, THIN
FILMS (U)

THE REPORT IS CONCERNED WITH TWO AREAS IN THE
CADMIUM SULFIDE THIN FILM SOLAR CELL DEVELOPMENT
PROGRAM: (1) A REPORT ON SPACE FLIGHT TESTING
OF CDS CELLS AND (2) RESULTS OF A DEVELOPMENT
PROGRAM FOR IMPROVING THE STABILITY AND EFFICIENCY OF
THE STANDARD CDS CELL. TWO SPACE FLIGHT TESTS
OF CDS CELLS ARE REPORTED. THE FIRST TEST,
ARX-701, CONTAINED TWO CDS PANELS ON THE OVI-
13 SATELLITE. THE SECOND SPACE FLIGHT TEST
CONTAINED ONE CDS PANEL, ARX-901, AND WAS FLOWN
ON THE OVI-17 SATELLITE. A DEVELOPMENT PROGRAM
FOR OBTAINING ENGINEERING MEASUREMENTS FROM THE
CDS CELL WAS CARRIED OUT. A STUDY WAS MADE OF
HEATING EFFECTS ON THE CADMIUM SULFIDE THIN FILM CELL
AFTER FORMATION OF THE BARRIER LAYER. ADDITIONAL
INVESTIGATIONS WERE MADE OF LOW PRESSURE LAMINATIONS,
A SILVER COATED GLASS POWDER FOR METALLIZED SUBSTRATE
USE AND VARIATIONS IN GRIDGING ATTACHMENT.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 726 114 1G/2 20/12
NORTHEASTERN UNIV BOSTON MASS

RESEARCH IN SOLAR ENERGY CONVERSION.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 1 OCT 66-30 SEP 70,
JAN 71 163P NOWAK, WELVILLE B. ;
CONTRACT: F19628-67-C-0119
PROJ: AF-8659
TASK: 865901
MONITOR: AFCRL 71-0163

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, RELIABILITY(ELECTRONICS)),
(*PHOTOELECTRIC CELLS(SEMICONDUCTOR), MANUFACTURING),
SEMICONDUCTING FILMS, VAPOR PLATING,
CARRIERS(SEMICONDUCTORS), SILICON, EPITAXIAL GROWTH,
COMPUTER PROGRAMS, ABSORPTION SPECTRA, ELECTRICAL
PROPERTIES, GALLIUM COMPOUNDS, PHOSPHIDES, GALLIUM
ARSENIDES, GERMANIUM, ZINC COMPOUNDS, SELENIDES (U)
IDENTIFIERS: ZINC SELENIDES, GALLIUM PHOSPHIDES,
HETEROJUNCTIONS (U)

THE FOLLOWING TOPICS RELATED TO PHOTOVOLTAIC SOLAR-
ENERGY CONVERSION WERE INVESTIGATED: TRANSIENT
RESPONSE OF MOMENTARILY REVERSE-BIASED
SOLAR CELLS, ELECTRODIFFUSION EFFECTS IN
SEMICONDUCTORS, EFFECT OF ELECTRIC FIELDS AND
CHARGED PARTICLE IMPINGEMENT ON PLANAR-
EDGE-GROWTH OF SINGLE CRYSTAL SILICON
FILMS ON AMORPHOUS QUARTZ, AND HETEROJUNCTION
PHOTOVOLTAIC SOLAR CELLS. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 728 186 10/2 18/8
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

COMPARISON OF LOW-ENERGY PROTON DAMAGE IN
ION-IMPLANTED AND DIFFUSED SILICON SOLAR
CELLS.

(U)

DESCRIPTIVE NOTE: JOURNAL ARTICLE,
SEP 70 3P STANLEY, ALAN G. ;
REPT. NO. JA-3779
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-71-129

UNCLASSIFIED REPORT

AVAILABILITY: PUB. IN PROCEEDINGS OF THE IEEE,
V59 N2 P321-322 FEB 71.

DESCRIPTORS: (*SOLAR CELLS, *RADIATION DAMAGE), PROTON
BOMBARDMENT, SILICON (U)
IDENTIFIERS: ION IMPLANTATION (U)

A COMPARISON IS MADE OF LOW-ENERGY PROTON DAMAGE IN
ION-IMPLANTED AND DIFFUSED SILICON SOLAR CELLS. IT
IS SHOWN THAT ION-IMPLANTED CELLS ARE MORE RADIATION
RESISTANT. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 731 940 10/2 22/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

SOLAR CELL DEGRADATION EXPERIMENTS ON THE
LINCOLN LABORATORY LES-4 AND LES-5
SATELLITES.

(U)

DESCRIPTIVE NOTE: JOURNAL ARTICLE,
OCT 69 6P SARLES, F. WILLIAM, JR.;
COX, LARRY P.;
REPT. NO. JA-3895
CONTRACT: AF 19(628)-5167
MONITOR: ESD TR-71-260

UNCLASSIFIED REPORT

AVAILABILITY: PUB. IN IEEE TRANSACTIONS ON
ELECTRON DEVICES, VED-18 NR P507-511 AUG 71.
SUPPLEMENTARY NOTE: PRESENTED AT THE IEEE PHOTOVOLTAIC
SPECIALISTS CONFERENCE (7TH) HELD IN PASADENA,
CALIF. 19-21 NOV 68.

DESCRIPTORS: (*SOLAR CELLS, DEGRADATION), (*SCIENTIFIC
SATELLITES, SOLAR CELLS), APOGEE, PERIGEE, ELLIPTICAL
ORBIT TRAJECTORIES, SILICON COATINGS, FILMS, CADMIUM
SULFIDES, TELLURIUM COMPOUNDS, SOLAR RADIATION (U)
IDENTIFIERS: LES-5 SATELLITE, LES-4 SATELLITE (U)

LES-4 WAS ORBITED IN DECEMBER 1965 IN A HIGHLY
ELLIPTICAL ORBIT WITH AN 18,000-MI APOGEE AND A 100-
MI PERIGEE; LES-5 WAS INJECTED INTO A QUASI-
SYNCHRONOUS ORBIT IN JULY 1967. IN THE LES-5
EXPERIMENT, THE SI CELLS EXHIBIT AN I(SC)
DEGRADATION OF EIGHT PERCENT PER YEAR PLUS AN INITIAL
SHORT TERM DEGRADATION OF FOUR PERCENT; V(AC) IS
RELATIVELY UNAFFECTED. THE CDS CELLS HAVE AN
I(SC) DEGRADATION OF 20 PERCENT PER YEAR PLUS AN
INITIAL DEGRADATION OF FIVE PERCENT. IN THE LES-4
EXPERIMENT, THE SI CELL WITH THE 6-MIL COVER SLIDE
SHOWS TWO RATES OF DEGRADATION, WITH THE BREAK POINT
OCCURRING AT ABOUT 100 DAYS; THE CELL WITH THE 30-MIL
COVER SLIDE SHOWS SUBSTANTIALLY LESS DEGRADATION.
AFTER 700 DAYS, THE SHORT-CIRCUIT CURRENTS OF THESE
TWO CELLS ARE 60 PERCENT AND 78 PERCENT OF THEIR
INITIAL AMO VALUES. ONE CDTE CELL HAS
DECAYED TO 38 PERCENT OF ITS INITIAL AMO VALUE
AFTER 700 DAYS; THE SECOND SAMPLE GIVES ANOMALOUS
RESULTS. IN EACH EXPERIMENT AMO TO AM2
SHORTCIRCUIT CURRENT RATIOS OF APPROXIMATELY 1.09
WERE NOTED. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 734 536 20/12 10/2
HUGHES AIRCRAFT CO CULVER CITY CALIF ELECTRONIC PROPERTIES
INFORMATION CENTER

CUPROUS SULFIDE AND CUPROUS SULFIDE-CADMIUM
SULFIDE HETEROJUNCTIONS.

(U)

DESCRIPTIVE NOTE: INTERIM REPT.,
SEP 71 62P NEUBERGER, M. ;
REPT. NO. EPIC-IR-69-REV
CONTRACT: DSA900-72-C-1182

UNCLASSIFIED REPORT

DESCRIPTORS: (*SEMICONDUCTORS, PHYSICAL PROPERTIES),
(*SOLAR CELLS, SULFIDES), COPPER COMPOUNDS, CADMIUM
SULFIDES, SEMICONDUCTING FILMS, ELECTRICAL PROPERTIES,
THERMAL PROPERTIES, OPTICAL PROPERTIES, PHOTOELECTRIC
EFFECT, BAND THEORY OF SOLIDS (U)
IDENTIFIERS: PHOTOVOLTAIC EFFECT, SEMICONDUCTOR
JUNCTIONS, HETEROJUNCTIONS, COPPER SULFIDES (U)

56 EXTRACTS OF DOCUMENTS WHICH PROVIDE INFORMATION ON
CUPROUS SULFIDE AND CUPROUS SULFIDE-CADMIUM
SULFIDE FROM THE ELECTRONIC PROPERTIES
INFORMATION CENTER STORAGE AND RETRIEVAL SYSTEM
ARE PROVIDED. CONSIDERABLE MINERALOGICAL
INFORMATION AS WELL AS PHASE DIAGRAMS, PHYSICAL
PROPERTIES AND PHOTOVOLTAIC PROPERTIES ARE INCLUDED.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 737 161 10/2
MASSACHUSETTS INST OF TECH LEXINGTON LINCOLN LAB

STRUCTURAL FAILURES IN LIGHTWEIGHT SOLAR
CELL ARRAYS UNDER THERMAL CYCLING.

(U)

DESCRIPTIVE NOTE: JOURNAL ARTICLE,
NOV 70 8P STANLEY, ALAN G. ;
REPT. NO. JA-3835
CONTRACT: F19628-70-C-0230
MONITOR: ESD TR-71-331

UNCLASSIFIED REPORT

AVAILABILITY: PUB. IN IEEE TRANSACTIONS ON
AEROSPACE AND ELECTRONIC SYSTEMS, VAES-7 N4 P606-
612 JUL 71.

DESCRIPTORS: (*SOLAR CELLS, THERMAL STRESSES), TEST
METHODS, SILICON, HONEYCOMB CORES, FLEXIBLE STRUCTURES,
FAILURE(MECHANICS), CRYOGENICS, VIBRATION (U)
IDENTIFIERS: *THERMAL CYCLING TESTS, FAILURE
ANALYSIS (U)

SEVERAL DIFFERENT TYPES OF SMALL SILICON SOLAR CELL
ARRAYS MOUNTED ON LIGHTWEIGHT HONEYCOMB PANELS AND ON
FLEXIBLE SUBSTRATES WERE SUBJECTED TO LONG-TERM
THERMAL CYCLING TESTS BETWEEN -160 AND 60C IN DRY
NITROGEN. OTHER TESTS INCLUDED IMMERSION IN LIQUID
NITROGEN AND VIBRATION FATIGUE TESTS IN EXCESS OF ONE
MILLION CYCLES. THE ARRAYS EXPERIENCED A REDUCTION
IN OUTPUT CAUSED BY CONTACT FAILURE, FRACTURE IN THE
SILICON AND COVER SLIDE, AND DISINTEGRATION OF THE
HONEYCOMB. FAILURE MODES CAUSED BY DIFFERENT CELL
AND INTERCONNECT CONSTRUCTIONS ARE COMPARED. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 740 577 10/2 18/8
AIR FORCE CAMBRIDGE RESEARCH LABS L G HANSCOM FIELD
MASS

SOLAR CELL RADATION RESPONSE NEAR THE
INTERFACE OF DIFFERENT ATOMIC NUMBER
MATERIALS. (U)

DESCRIPTIVE NOTE: PHYSICAL SCIENCES RESEARCH PAPERS,
NOV 71 23P BURKE, E. A. ;CAPPELLI, J.
R. ;LOWE, J. F. ;WALL, J. A. ;
REPT. NO. AFCRL-72-0045; AFCRL-PSRP-472
PROJ: AF-5621
TASK: 562109

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), COBALT, GAMMA
RAYS, INTERFACES, ALUMINUM, GOLD, COPPER, MOLYBDENUM,
SILICON, (U)SILICON (U)
IDENTIFIERS: COBALT 60, THIN FILMS (U)

THE RESPONSE OF CO-60 IRRADIATED N/P SILICON
SOLAR CELLS WAS MEASURED AS A FUNCTION OF THE ATOMIC
NUMBER OF THE MEDIUM ADJACENT TO THE CELL AND THE
DIRECTION OF THE GAMMA RAY BEAM. THE
INTERPOSITIONING OF VARIOUS THICKNESSES OF ALUMINUM
BETWEEN THE ADJACENT MATERIAL AND THE CELL HAD THE
EFFECT OF MOVING THE CELL TO VARIOUS LOCATIONS IN AN
APPROXIMATE MONOATOMIC NUMBERED MEDIUM. WITH THIS
TECHNIQUE, THE SOLAR CELL RESPONSE WAS DETERMINED AT
VARIOUS DISTANCES FROM THE INTERFACE FOR GOLD AND
BERYLLIUM. IONIZATION CHAMBER DATA WERE USED TO
ESTIMATE THE INFLUENCE OF VARIOUS BASE CONTACT
MATERIALS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 741 524 10/2 22/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

SPACE ELECTRIC POWER PLANTS. PART I
(LITSON K SOLNTSU),

(U)

72 7P LIDORENKO, N. ;
REPT. NO. FSTC-MT-23-923-72
PROJ: FSTC-T7023012301

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. FROM PRAVDA, MOSCOW
(USSR) N160 P3, 9 JUN 71, BY DONALD E.
CHAMBERLIN.

DESCRIPTORS: (*SOLAR CELLS, SPACECRAFT COMPONENTS),
ENERGY CONVERSION, SEMICONDUCTOR DEVICES, USSR
IDENTIFIERS: SOLAR GENERATORS, TRANSLATIONS

(U)

(U)

THE THEORETICAL ASPECT OF SOLAR POWER PLANTS OF
SOVIET SPACECRAFT IS EXPLAINED BY LIDORENKO, AN
EXPERT IN THE FIELD OF RECHARGEABLE POWER SOURCES.
DEVELOPMENT OF SOLAR BATTERIES FOR LUNOKHOD-1
SOLVES NEW PROBLEMS. THE TYPE OF SEMICONDUCTOR
CHOSEN PERFORMS WELL IN THE 100-150C AND WITHSTANDS
VIGOROUS COOLING. THE SEMICONDUCTOR PASSED THROUGH
A LUNAR ECLIPSE INTACT WHEN THE COVER OF THE
LUNOKHOD WAS LEFT OPEN. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 745 364 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

A STUDY OF 'PHOTOVOLT' GENERATOR AT HIGH
RADIATION INTENSITY (ISSLEDOVANIIE
ELEKTRICHESKIKH KHKARAKTERISTIK GENERATOROV
'FOTOVOLT' PRI POVYSHENNOI MOSHCHNOSTI
IZLUCHENIYA),

(U)

JUN 72 5P LANDSMAN, A. P. ; STREBKOV,
D. S. ;
REPT. NO. FSTC-HT-23-1014-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. FROM GELIOTEKHNKA (USSR)
N3 P3-6 1970, BY ALBERT L. PEABODY.

DESCRIPTORS: (*SOLAR CELLS, DESIGN), PHOTOELECTRIC
CELLS(SEMICONDUCTOR), PHOTSENSITIVITY, ELECTRICAL
PROPERTIES, USSR

(U)

IDENTIFIERS: PHOTOVOLTAIC CELLS, SOLAR GENERATORS,
TRANSLATIONS

(U)

THE NEW HIGH VOLTAGE PHOTOELECTRIC GENERATOR
'PHOTOVOLT' IS DESCRIBED. THE SPECTRAL
SENSITIVITY AND CURRENT-VOLTAGE CHARACTERISTICS ARE
GIVEN. THE GENERATOR EFFICIENCY RISES FROM 78 TO
108 WHILE THE LIGHT POWER INCREASES FROM NORMAL
VALUE UP TO 4 KW/SQ M. (AUTHOR)

(U)

UNCLASSIFIED

DCC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 748 694 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

SOLAR BATTERY-PHOTOVOLTAIC CELL POWER
SUPPLY FOR EQUIPMENT (USTROISTVO DLYA
PITANIYA POTREBITELEI OT SOLNECHNOI BATAREI
S FOTOPREOBRAZO VATELYAMI). (U)

JUN 72 2P GRIGORYAN, R. S. ;
REPT. NO. FSTC-HT-23-750-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF PATENT (USSR) 271
619.

DESCRIPTORS: (*POWER SUPPLIES, *SOLAR CELLS),
(*SWITCHING CIRCUITS, POWER SUPPLIES), ELECTRIC RELAYS,
DETECTORS, PATENTS, USSR (U)
IDENTIFIERS: TRANSLATIONS (U)

A DEVICE IS DESCRIBED FOR THE POWER SUPPLY OF
CONSUMERS BY A SOLAR BATTERY WITH PHOTOCONVERTORS
CONTAINING A COMMUTATOR TO CONNECT THE LOADS TO THE
BATTERY. TO INCREASE RELIABILITY, THE COMMUTATOR
HAS RELAYS AND POWER SENSORS, THE CONTACTS OF WHICH
ARE INCLUDED IN THE CIRCUIT OF THE COIL OF A RELAY
SEPARATING THE SOLAR BATTERY INTO SEVERAL SECTIONS,
EACH OF WHICH IS CONNECTED TO AN INDIVIDUAL CONSUMER
THROUGH THE CONTACT OF THIS RELAY. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 749 477 10/2 18/8
BOFING CO SEATTLE WASH

REAL-TIME SPACE AND NUCLEAR EFFECTS ON
SOLAR CELLS (ACCELERATED EVALUATION
METHODS).

(U)

DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT. 17 MAY 71-17
MAY 72,

AUG 72 88P HORNE, WILLIAM E. ; MADARAS,
BARBARA K. ;
CONTRACT: F33615-71-C-1583
PROJ: AF-3145
MONITOR: AFAPL TR-72-69

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), (*SEMICONDUCTORS,
DAMAGE), (*SILICON, DAMAGE), DOPING, LITHIUM, ELECTRON
IRRADIATION, PROTON BOMBARDMENT, NUCLEAR EXPLOSIONS,
TEST METHODS, CRYSTAL DEFECTS, GAMMA RAYS, REAL TIME,
(U)REAL TIME (U)

IDENTIFIERS: ACCELERATED TESTS, RADIATION HARDENING,
*HARDENING(SYSTEMS) (U)

A TECHNIQUE IS BEING DEVELOPED FOR THE ACCELERATED
EVALUATION OF SILICON SOLAR CELLS TO BE USED IN
EXTENDED SPACE MISSIONS DURING WHICH WEAPONS
ENVIRONMENTS MAY ALSO BE ENCOUNTERED. STANDARD N/
P SILICON CELLS, AS WELL AS LITHIUM DOPED SILICON
CELLS, ARE BEING USED AS TEST SAMPLES DURING THE
DEVELOPMENT AND VERIFICATION OF THE EVALUATION
METHOD. THE REPORT DISCUSSES AN ANALYSIS OF
EXISTING LITERATURE AND THE PHILOSOPHY OF APPROACH TO
THE PROBLEM RESULTING FROM THE ANALYSIS. AN
EXPLORATORY TEST PROGRAM DESIGNED TO AUGMENT EXISTING
DATA AND TO FURTHER DEVELOP THE METHOD OF APPROACH IS
DESCRIBED. ALSO, A REAL-TIME TEST CURRENTLY
UNDERWAY WHICH INVOLVES N/P AND LITHIUM DOPED
SOLAR CELLS EXPOSED SIMULTANEOUSLY TO LOW-FLUX
ELECTRON AND PROTON RADIATION PLUS ILLUMINATION IS
DESCRIBED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 754 901 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

THEORETICAL TREATMENT OF THE VERTICAL
MULTIJUNCTION SOLAR CELL.

(U)

DESCRIPTIVE NOTE: REPT. FOR 1 JUL 71-1 MAR 72,
DEC 72 42P RAHILLY, W. PATRICK ;
REPT. NO. AFAPL-TR-72-77
PROJ: AF-3145

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, EFFICIENCY),
CARRIERS(SEMICONDUCTORS), ELECTRIC CURRENTS, VOLTAGE,
DESIGN, DAMAGE, RADIATION EFFECTS (U)
IDENTIFIERS: SEMICONDUCTOR JUNCTIONS (U)

A BRIEF THEORETICAL TREATMENT OF THE VERTICAL
MULTIJUNCTION SOLAR CELL IS PRESENTED. THE CELL
GEOMETRY CONSIDERED WAS 2 CM X 2 CM X 250 MICRONS.
SOLUTIONS FOR THE MINORITY CARRIER DIFFUSION
EQUATIONS WERE OBTAINED SO AS TO DERIVE THE LIGHT
GENERATED CURRENT PER UNIT WAVELENGTH (SPECTRAL
RESPONSE) AND TOTAL LIGHT GENERATED CURRENT. THE
SPECTRAL RESPONSE CALCULATIONS REVEALED THAT ENHANCED
CARRIER COLLECTION IS PREDICTED IN THE 'RED' PORTION
OF THE SUNLIGHT SPECTRUM. THE TOTAL LIGHT
GENERATED CURRENT WAS FOUND TO INCREASE
ASYMPTOTICALLY TO A LIMIT OF NOMINALLY 190
MILLIAMPERES FOR INCREASING NUMBERS OF JUNCTIONS.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 755 743 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

STATUS REPORT ON RAE ADVANCED SOLAR ARRAY
DEVELOPMENT.

(U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUL 72 31P TREBLE, F. C. ;
REPT. NO. RAE-TR-72109
MONITOR: DRIC BR-29829

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE IEEE PHOTOVOLTAIC
SPECIALISTS' CONFERENCE, (9TH) SILVER SPRING,
MD., 2-4 MAY 72.

DESCRIPTORS: (*SOLAR CELLS, PERFORMANCE(ENGINEERING)),
(*SPACECRAFT COMPONENTS, SOLAR CELLS), DESIGN, GREAT
BRITAIN, DAMAGE, RADIATION EFFECTS, SPACE ENVIRONMENTS,
PROTON BOMBARDMENT (U)

RECENT PROGRESS IN ADVANCED LIGHTWEIGHT SOLAR ARRAY
TECHNOLOGY IS REVIEWED. SOLAR CELL PERFORMANCE WAS
IMPROVED. PANEL ASSEMBLIES EMBODYING THE
CEMENTLESS MOUNTING TECHNIQUE HAVE SUCCESSFULLY
WITHSTOOD PROLONGED DEEP THERMAL CYCLING AND OTHER
ENVIRONMENTAL TESTS. SOME ARE CURRENTLY BEING FLOWN
EXPERIMENTALLY ON THE PROSPERO TECHNOLOGICAL
SATELLITE. A STOWED ARRAY HAS SURVIVED SEVERE
VIBRATION WITH NEGLIGIBLE DAMAGE. A SOLUTION HAS
BEEN FOUND TO THE PROBLEM OF PROTECTING THE BACKS OF
THE CELLS FROM LOW ENERGY PROTONS. USEFUL
EXPERIENCE HAS BEEN GAINED IN ALL ASPECTS OF THE
MANUFACTURE, HANDLING AND TESTING OF FLEXIBLE FOLDING
ARRAYS. DESIGN QUALIFICATION TESTS HAVE BEGUN ON A
280W PROTOTYPE. THE ADVANTAGES AND DISADVANTAGES
OF THE DESIGN IN RELATION TO THE ALTERNATIVE ROLL-UP
TYPE ARE DISCUSSED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 756 039 10/2 22/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

SPACE ELECTRIC POWER PLANTS. PART 2, (U)

FEB 73 6P KOROLEV, M. ;
REPT. NO. FSTC-HT-23-921-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF PRAVDA, MOSCOW (USSR)
N161 P3, 10 JUN 71. SEE ALSO PART 1, AD-741
524.

DESCRIPTORS: (*SOLAR PANELS, SPACECRAFT COMPONENTS),
SOLAR CELLS, LIFE EXPECTANCY, PHOTOELECTRIC
CELLS(SEMICONDUCTOR), SILICON, INTEGRATED CIRCUITS,
ELECTRIC POWER PRODUCTION, USSR (U)
IDENTIFIERS: *SOLAR GENERATORS, TRANSLATIONS (U)

SOLAR BATTERIES AND POWER CELLS ARE DISCUSSED. 7,
500 PHOTOCELLS COMPRISING A PANEL 1 METER SQUARE
GENERATE MORE THAN 100 WATTS OF ELECTRICAL ENERGY.
SPACE SERVICE LIFE OF CERTAIN SEMICONDUCTORS IS
GIVEN AS TWO TO THREE YEARS. GLASS COATINGS
PROTECT PANELS FROM HEAVY PROTONS. REFERENCE IS
MADE TO THE BOEING CO. PROJECT OF UNFOLDING GLASS
FABRIC PANELS FOR SPACE USE. KOROLEV ALSO STATES
THAT SOVIET SCIENTISTS CONFIRM THE FEASIBILITY OF
SUCH A PROJECT BUT CLAIM THAT IT WILL BE SURPASSED.
THIN FILM HIGHLY EFFICIENT PHOTOCCELL PANELS HAVE
BEEN DEVELOPED IN THE USSR. REFERENCE IS MADE TO
AN UNSPECIFIED PLANT/FACTORY WHICH MANUFACTURES NOT
ONLY SPACE POWER UNITS (USING SOLAR ENERGY) BUT
GROUND SOLAR POWER PLANTS AS WELL. A 600 WATT
PILOT INSTALLATION HAS BEEN IN OPERATION IN THE
KARAKUM DESERT. (AUTHOR) (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 756 228 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

INVESTIGATION OF PHOTOELECTRIC CHARACTERISTICS
OF GALLIUM ARSENIDE SOLAR CELLS OVER A WIDE
RANGE OF CHANGE IN LIGHT FLUX, (U)

JAN 73 13P KAGAN, M. B. ILYUBASHEVSKAYA,
T. L. ;
REPT. NO. FSTC-MT-23-2027-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF GELIOTEKNIKA (USSR) N2
P12-21 1971.

DESCRIPTORS: (*SOLAR CELLS, *GALLIUM ARSENIDES),
PHOTOELECTRIC CELLS(SEMICONDUCTOR), SILICON,
RELIABILITY(ELECTRONICS), USSR (U)
IDENTIFIERS: COMPARISON, TRANSLATIONS (U)

THE CHARACTERISTICS OF GALLIUM ARSENIDE AS SOLAR
CELLS IN THE 4 WATT/SQ M-72000 WATT/SQ M ILLUMINATION
RANGE ARE ANALYZED IN THIS RUSSIAN REPORT. THE
CONNECTION OF THE OBSERVED RELATIONSHIPS WITH THE
ELECTRO-PHYSICAL PARAMETERS OF P-N JUNCTIONS ARE
DETERMINED, AND COMPARED WITH SILICON. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 756 594 20/12 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

HETEROGENEOUS SOLAR CONVERTORS BASED ON
POLYCRYSTALLINE CADMIUM SULFIDE AND CADMIUM
SELENIDE (GETEROGENNE SOLNECHNE
PREOBRAZOVATELI NA OSNOVE POLIKRISTALLICHESKOGO
SULFIDA I SELENIDA KADMIYA), ? (U)

SEP 72 IOP KOMASHCHENKO, V. N. ;
MARCHENKO, A. I. ; FEDORUS, G. A. ;
REPT. NO. FSTC-HT-23-113-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF POLUPROVODNIKOVAYA
TEKHNIKA I MIKROELEKTRONIKA (USSR) N4 P112-121 N.D.,
BY A. PEABODY.

DESCRIPTORS: (*SEMICONDUCTING FILMS, *SOLAR CELLS),
CADMIUM SULFIDES, CADMIUM SELENIDES, PHOTSENSITIVITY,
ELECTRICAL PROPERTIES, USSR (U)
IDENTIFIERS: THIN FILMS, TRANSLATIONS (U)

THE AUTHORS PRESENT DATA ON THE DEVELOPMENT AND
INVESTIGATION OF PHOTOELECTRIC CONVERTORS BASED ON
PRESSED SINTERED TABLETS OF CDS AND CDSE,
PLUS SOMEWHAT MORE DETAILED DATA ON PHOTOELECTRIC
CONVERTORS BASED ON CDSE FILMS. (U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 756 602 10/2 20/12
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

EFFECTIVENESS OF SOLAR CELLS BASED ON CDS-
CUZ-XS HETEROJUNCTIONS,

(U)

DEC 72 9P PAVELETS, S. YU. ;
REPT. NO. FSTC-HT-23-2032-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF GELIOTEKNIKA (USSR) N3
P3-8 1971.

DESCRIPTORS: (*PHOTOELECTRIC CELLS (SEMICONDUCTOR),
EFFICIENCY), (*SOLAR CELLS, EFFICIENCY), COPPER
COMPOUNDS, SURFACES, BAND THEORY OF SOLIDS, USSR,
CADMIUM SULFIDES

(U)

IDENTIFIERS: HETEROJUNCTIONS, TRANSLATIONS, COPPER
SULFIDES

(U)

ANALYSIS OF LOSS AND CHANCES OF EFFICIENCY INCREASE
IN CDS-CU(2-X)S PHOTOCONVERTERS WITH
IMPURITY LIGHT ABSORPTION SHOWS THAT EFFECTIVE
PHOTOCELLS CAN BE PRODUCED ONLY WITH USE OF THE DRIFT
FIELD AND CHARACTERISTICS OF THE FLOW OF THE CHEMICAL
REACTION WHICH FORMS CU(2-X)S ON THE CDS
SURFACE. THE RUSSIAN REPORT DISCUSSES THE FACT
THAT FURTHER PROGRESS IS POSSIBLE IN THE PRODUCTION
OF SOLAR BATTERIES BASED ON CDS-CU(2-X)S
HETEROJUNCTIONS AS A RESULT OF SELECTION OF THE
OPTIMUM MODE OF CHEMICAL TREATMENT, IN THE PRESENCE
OF THE OPTIMUM POLYCRYSTALLINE STRUCTURE OF CDS
LAYERS.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 759 290 21/3 22/2 22/1
TECHNION INC MONROVIA CALIF.

ADVANCED ELECTRIC THRUSTER (A SPACE
ELECTRIC RAMJET).

(U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT.,
APR 73 117P CANN, GORDON L. ;
CONTRACT: F04611-73-C-0020
PROJ: AF-10-003
MONITOR: AFRPL TR-73-12

UNCLASSIFIED REPORT

DESCRIPTORS: (*ELECTRIC ENGINES,
PERFORMANCE(ENGINEERING)), (*SPACE PROPULSION,
ASTRONAUTICS), DESIGN, ARC JET ENGINES, ION ENGINES,
PLASMA ENGINES, MAGNETIC FIELDS, DRAG, SOLAR CELLS (U)
IDENTIFIERS: STATIONKEEPING, THRUSTERS (U)

LABORATORY EXPERIMENTS HAVE ESTABLISHED THAT
AXISYMMETRIC PLASMA ACCELERATORS USING A SOLENOIDAL
MAGNETIC FIELD CAN PRODUCE THRUST BY RECYCLING THE
AMBIENT MATERIAL OF THE VACUUM TANK IN WHICH THEY
WERE OPERATED, INDICATING THAT AN ELECTROMAGNETIC
ACCELERATOR ON A SATELLITE AT LOW ALTITUDE SHOULD BE
ABLE TO IONIZE AND ACCELERATE AIR STREAMING BY IT AND
PRODUCE THRUST FOR DRAG MAKE UP. THIS PRINCIPLE IS
THE BASIS OF THE SPACE ELECTRIC RAMJET. USE OF
SOLAR CELL ARRAYS TO SUPPLY POWER GIVES THE SYSTEM A
THEORETICAL UNLIMITED TOTAL IMPULSE, OTHERWISE
LIMITED BY ENGINE CATHODE AND ANODE LIFETIMES.
MINIMUM SYSTEM PERFORMANCE REQUIREMENTS FOR DRAG
MAKE UP IN THE 100-300 MILES ALTITUDE RANGE ARE
COMPUTED. BASIC DESIGN PARAMETERS FOR SYSTEM
COMPONENTS (ANODE, CATHODE, MAGNET COIL,
INSULATORS) AND POWER REQUIREMENTS ARE CALCULATED.
(AUTHOR MODIFIED ABSTRACT)

(U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 759 812 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

CALCULATION AND COST OPTIMIZATION OF CERTAIN
SOLAR GENERATOR THERMOBATTERY PARAMETERS (K
RASCHETU I OPTIMIZATSII PO STOIMOSTI
NEKOTORYKH PARAMETROV TERMOBATAREI
SOLNECHNYKH GENERATOROV),

(U)

JAN 73 IIP DRABKIN, L. M. ;
REPT. NO. FSTC-HT-23-1433-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF GELIOTEKNIKA (USSR) NI
P9-15 1971.

DESCRIPTORS: (*THERMOELECTRICITY, COSTS), (*SOLAR CELLS,
COSTS), PRODUCTION, BATTERY COMPONENTS, ELECTRIC
BATTERIES, MATHEMATICAL MODELS, USSR, DESIGN (U)
IDENTIFIERS: TRANSLATIONS (U)

A METHOD FOR ECONOMIC ANALYSIS OF THERMOELECTRIC
GENERATORS IS DISCUSSED IN THE RUSSIAN REPORT. A
FORMULA IS PRESENTED WHICH PERMITS CALCULATION OF THE
COST OF MANUFACTURE OF A THERMOELECTRIC GENERATOR
THERMOBATTERY (IF MATERIAL OUTLAY ON IT IS
KNOWN). FROM THE FORMULA PROPOSED, IT FOLLOWS IN
PARTICULAR THAT, WITH A DECREASE IN THE WEIGHT OF
MATERIALS, THE COST OF A BATTERY DECREASES LINEARLY.
HOWEVER, WITH A DECREASE IN THE WEIGHT OF MATERIALS
(THICKNESS OF THERMOELEMENTS), THE NUMBER OF
THERMOELEMENTS PER WATT GENERATED GROWS, APPROACHING
INFINITY. WAGE EXPENDITURES ALSO INCREASE
CONSIDERABLY HERE. THE FORMULA DOES NOT TAKE ALL
FACTORS INTO ACCOUNT, AND IT IS IMPOSSIBLE TO BUILD
UP A METHOD FOR OPTIMIZING THERMOBATTERY CONSTRUCTION
PARAMETER DESIGN, ESPECIALLY FOR THE SOLAR
THERMOELECTRIC GENERATOR. (AUTHOR MODIFIED
ABSTRACT)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 759 946 9/1 23/12 18/8
NORTHROP RESEARCH AND TECHNOLOGY CENTER HAWTHORNE
CALIF

RADIATION EFFECTS ON SEMICONDUCTOR MATERIALS
AND DEVICES.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 8 FEB-8 DEC 72,
MAR 73 210P SROUR, JOSEPH R. ;OTHMER,
SIEGFRIED ;CURTIS, ORLIE L. , JR;
REPT. NO. NRTC-72-16R
CONTRACT: DAAG39-69-C-0039, DAAG39-73-C-0019
PROJ: HDL-235227
MONITOR: HDL 039-3

UNCLASSIFIED REPORT

DESCRIPTORS: (*SEMICONDUCTOR DEVICES, DAMAGE),
(*SEMICONDUCTORS, *DAMAGE), RECOMBINATION REACTIONS,
CARRIERS(SEMICONDUCTORS), CRYSTAL DEFECTS, SILICON,
NEUTRON REACTIONS, ANNEALING, SOLAR CELLS, GALLIUM
ARSENIDES, GAMMA RAYS, PHOTOCONDUCTIVITY,
(U)PHOTOCONDUCTIVITY

(U)

TECHNIQUES ARE DESCRIBED FOR OBTAINING
RECOMBINATION-CENTER PARAMETERS FROM CARRIER LIFETIME
STUDIES. STUDIES OF RECOMBINATION AT DISORDERED
REGIONS INCLUDE DAMAGE COMPARISONS FOR FUSION- AND
FISSION-NEUTRON-IRRADIATED BULK SILICON AND SILICON
SOLAR CELLS, AND DIFFUSION LENGTH MEASUREMENTS IN
NEUTRON-IRRADIATED SILICON AND GALLIUM ARSENIDE.
SHORT-TERM ANNEALING INVESTIGATIONS INCLUDE THE
DEVELOPMENT OF EXPRESSIONS FOR EVALUATING EARLY-TIME
DAMAGE RATIOS AND STUDIES OF TRANSIENT RECOVERY IN
BULK SILICON, SILICON SOLAR CELLS, AND BIPOLAR
TRANSISTORS FOLLOWING BURSTS OF BOTH 14-MEV AND
REACTOR NEUTRONS. MEASUREMENT TECHNIQUES ARE
DESCRIBED FOR DETERMINING DRIFT MOBILITY IN HEAVILY
IRRADIATED SILICON AND FOR DETERMINING THE INJECTION-
LEVEL DEPENDENCE OF LIFETIME IN SEMICONDUCTORS. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 760 172 10/2
HELIOTEX SYLMAR CALIF

VERTICAL MULTIJUNCTION SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 15 NOV 71-15
DEC 72.

FEB 73 145P STELLA, PAUL M. ;
REPT. NO. 380-4654
CONTRACT: F33615-72-C-1310
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-73-3

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DESIGN),
CARRIERS(SEMICONDUCTORS), EFFICIENCY, PHOTOCONDUCTIVITY,
DAMAGE, RADIATION EFFECTS, ELECTRON IRRADIATION, NEUTRON
REACTIONS, RELIABILITY(ELECTRONICS), SILICON, SPACECRAFT
COMPONENTS, SPACE ENVIRONMENTS (U)
IDENTIFIERS: CARRIER LIFETIME, SEMICONDUCTOR
JUNCTIONS (U)

A THEORETICAL ANALYSIS OF THE VERTICAL
MULTIJUNCTION (VMJ) SOLAR CELL WAS PERFORMED WHICH
INDICATED THAT USING SILICON CERTAIN CONFIGURATIONS
COULD BE FABRICATED TO SATISFY THE PROGRAM
OBJECTIVES. RESULTS INDICATE THAT INITIAL AMO
EFFICIENCIES OF 15% CAN BE ACHIEVED, AND THAT AT
LEAST 12% EFFICIENCY CAN BE EXPECTED AFTER SEVEN
YEARS OPERATION AT SYNCHRONOUS ORBIT IN A NUCLEAR
WEAPONS ENVIRONMENT. EXPERIMENTAL DEVICES
FABRICATED DURING THE PROGRAM EXHIBITED RELATIVELY
HIGH LONG WAVELENGTH RESPONSE AS PREDICTED BY THEORY.
THESE OVERSIZE DEVICES (WIDTHS APPROXIMATELY 100
MICROMETERS) EXHIBITED LOW EFFICIENCIES (6-8%)
AND POOR SHORT WAVELENGTH RESPONSE DUE TO SLOW
SURFACE STATES WHICH DRASTICALLY REDUCED SHORT
WAVELENGTH COLLECTION EFFICIENCY AND DEVICE VOLTAGE
AS WELL AS CAUSING INSTABILITY IN THE DEVICE I-V
CHARACTERISTIC. THESE SURFACE STATES MUST BE
ELIMINATED IF HIGH EFFICIENCY VMJ DEVICES ARE TO
BECOME A REALITY. (MODIFIED AUTHOR ABSTRACT) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 762 941 10/2
ION PHYSICS CORP BURLINGTON MASS

LONG LIFE HARDENED LITHIUM DOPED SILICON
SOLAR CELL INVESTIGATION.

(U)

DESCRIPTIVE NOTE: FINAL REPT. MAY 70-DEC 72.
JUN 73 124P BARTELS, F. T. C. ;
CONTRACT: F33615-70-C-1491
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-73-47

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DAMAGE); SILICON, LITHIUM,
DOPING, LIFE EXPECTANCY, MANUFACTURING, ULTRASONIC
WELDING, MODULES(ELECTRONICS),
(U)MODULES(ELECTRONICS)
IDENTIFIERS: RADIATION HARDENING

(U)

(U)

A REPORT IS MADE ON A PROGRAM TO DEVELOP LITHIUM-
DOPED SILICON SOLAR CELLS WITH IMPROVED STABILITY,
EFFICIENCY, AND RADIATION RESISTANCE. A NOVEL CELL
STRUCTURE WITH AN ION-EMPLANTED BARRIER LAYER
IMMEDIATELY BELOW THE P-N JUNCTION WAS DEVELOPED
AND EVALUATED. THE MANUFACTURING PROCESS IS
DESCRIBED IN DETAIL. ACTUAL RESULTS FOR LITHIUM
DISTRIBUTION, ANNEALING CHARACTERISTICS AND CELL
STABILITY ARE COMPARED TO THEORETICAL PREDICTIONS FOR
BOTH BARRIER AND NON-BARRIER CELLS. MODULE
FABRICATION INCLUDING ALUMINUM WELDED INTERCONNECTS
AND INTEGRAL COVER GLASS IS DISCUSSED. PERFORMANCE
OF THE EXPERIMENTAL CELLS AFTER ELECTRON AND NEUTRON
IRRADIATION IS COMPARED TO THAT OF NON-BARRIER CELLS.
(MODIFIED AUTHOR ABSTRACT)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 764 357 10/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

LITHIUM-DOPED SILICON SOLAR CELLS STATE-
OF-THE-ART.

(U)

DESCRIPTIVE NOTE: TECHNICAL REPT. APR-OCT 72,
JUN 73 42P GREEN, JOHN M. ;
REPT. NO. AFAPL-TR-73-4
PROJ: AF-3145
TASK: 314519

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, STATE-OF-THE-ART REVIEWS),
SILICON, LITHIUM, DOPING, ENERGY CONVERSION, DAMAGE,
RADIATION EFFECTS, INHIBITION, SPACECRAFT COMPONENTS,
SPACE ENVIRONMENTS

(U)

THE PRESENT STATUS OF LITHIUM-DOPED SOLAR CELLS WAS
INVESTIGATED. IMPROVEMENTS IN FABRICATION
TECHNIQUES HAVE MADE POSSIBLE LITHIUM-DOPED CELLS
WHICH ARE 11.9% EFFICIENT AT AMO CONDITIONS AND
28 C. CELL AREAS OF 12 SQUARE CENTIMETERS ARE
NOW FEASIBLE. ANNEALING CHARACTERISTICS ARE HIGHLY
TEMPERATURE DEPENDENT WITH 60 C BEING THE MINIMUM
ARRAY TEMPERATURE FOR GOOD PERFORMANCE. IF THE
RECOVERED POWER LEVELS FOR N/P CELLS AND P/N
LITHIUM-DOPED CELLS ARE COMPARED FOR AN ARRAY
TEMPERATURE OF 80 C, IT IS FOUND THAT THE P/N
LITHIUM-DOPED CELLS ARE 15% HIGHER AFTER 10 TO THE
15TH POWER/SQ CM 1 MEV EQUIVALENT ELECTRONS AND
85% HIGHER AFTER 10 TO THE 13TH POWER/SQ CM FISSION
SPECTRUM NEUTRONS. BASED ON THIS SURVEY THE USE OF
LITHIUM-DOPED CELLS IS RECOMMENDED FOR MISSIONS WHICH
REQUIRE SOLAR ARRAYS TO OPERATE AT TEMPERATURES ABOVE
60 C, ESPECIALLY IF THE SATELLITE MUST SURVIVE A
NUCLEAR WEAPON ENVIRONMENT. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 764 816 10/2 9/1
GLOBE-UNION INC EL MONTE CALIF CENTRALAB SEMICONDUCTOR
DIV

ELECTROFORMED ALUMINUM SOLAR CELL
CONTRACTS.

(U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 1 FEB 72-30
MAR 73;

MAR 73 44P ILES, PETER A. ;

CONTRACT: F33615-72-C-1427

PROJ: AF-3145

TASK: 314519

MONITOR: AFAPL

TR-73-29

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, ELECTRIC CONNECTORS),
(*ELECTRIC CONNECTORS, *ELECTROFORMING), ALUMINUM,
SILICON, FEASIBILITY STUDIES, COST EFFECTIVENESS
IDENTIFIERS: ELECTRIC CONTACTS

(U)

(U)

INVESTIGATIONS WERE CONDUCTED TO EVALUATE THE
FEASIBILITY OF ACHIEVING IMPROVED ALUMINUM SOLAR CELL
CONTACTS AND INTERCONNECTS WHICH COULD REDUCE OVERALL
SOLAR ARRAY COST AND WEIGHT WITHOUT SACRIFICE OF
PERFORMANCE AND RELIABILITY. PROBLEMS OF POOR
ADHERENCE AND THICKNESS CONTROL OF THE CONTACT
METALLIZATION WERE ENCOUNTERED DURING THE COURSE OF
THE PROGRAM. EFFORTS TO RESOLVE THESE PROBLEMS WERE
UNSUCCESSFUL. BECAUSE OF THE SERIOUS CONTACT
METALLIZATION PROBLEMS, NO EFFORT WAS EXPENDED IN
ATTEMPTING TO ACHIEVE ADVANCED WRAP-AROUND CONTACT
CONFIGURATIONS OR INTERCONNECTION OF CELLS USING THE
ELECTROFORMING TECHNIQUE. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 771 426 10/2 22/2 18/8
BOEING AEROSPACE CO SEATTLE WASH

BAR GAP RADIATION TEST.

(U)

DESCRIPTIVE NOTE: FINAL REPT. OCT-DEC 73,
DEC 73 70P RUSSELL, DENNIS A. ;
REPT. NO. D180-17847-1
CONTRACT: N00014-74-C-0064

UNCLASSIFIED REPORT

DESCRIPTORS: *SPACECRAFT COMPONENTS, *SOLAR PANELS,
*RADIATION EFFECTS, PROTONS, ULTRAVIOLET
RADIATION, THERMAL CYCLING TESTS, SOLAR CELLS,
SATELLITES(ARTIFICIAL),
PERFORMANCE(ENGINEERING)

(U)

A TEST PROGRAM WAS CONDUCTED INVESTIGATING THE
EFFECTS OF PROTON AND ULTRAVIOLET RADIATION AND
THERMAL CYCLING ON U.S. NAVY SATELLITE SOLAR
PANELS. GOVERNMENT-SUPPLIED TEST PANELS WERE
PLACED IN A VACUUM CHAMBER AND EXPOSED ALTERNATELY TO
200-KEV PROTONS TO A FLUENCE OF 10 TO THE 15TH
POWER P/SQ CM, TO 270 HOURS OF ULTRAVIOLET RADIATION
AT A ONE SUN RATE, AND TO 21 THERMAL CYCLES. THE
PERFORMANCE OF THE TEST PANELS IN THE FORM OF I-V
CURVES WAS MEASURED IN SITU BEFORE THE START OF
TESTING AND PERIODICALLY THROUGHOUT THE TEST.
(AUTHOR;

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 772 817 10/2

KSW ELECTRONICS INC BURLINGTON MASS

LITHIUM IMPLANTED SOLAR CELLS, DATA.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUN-31 JUL 73,
JUL 73 23P SMITH, DONALD A. ; HARTKE,
JEROME L. ;

CONTRACT: F19628-73-C-0214

PROJ: AF-8659

TASK: 865906

MONITOR: AFCRL

TR-73-0493

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, SILICON, LITHIUM, ION
IMPLANTATION, DIFFUSION, PHOSPHORUS

(U)

THE REPORT CONTAINS THE IDENTIFICATION AND
PROCESSING DESCRIPTION OF ALL SAMPLES PROCESSED AND
THE TABULATED MEASUREMENT DATA OBTAINED ON PHOSPHORUS
DIFFUSED, LITHIUM IMPLANTED, P-TYPE SILICON SOLAR
CELL BLANKS. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 773 237 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

OPTIMIZATION OF SOLAR CELL SHIELDING FOR
GEOSTATIONARY MISSIONS.

(U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
AUG 73 41P WALKDEN, M. W. ;
REPT. NO. RAE-TR-73105
MONITOR: DRIC BR-36625

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *RADIATION SHIELDING,
SHIELDING, SYNCHRONOUS SATELLITES, THICKNESS,
OPTIMIZATION, GREAT BRITAIN

(U)

EQUIVALENT ONE MEV ELECTRON FLUENCES, END OF
LIFE OUTPUT POWERS AND POWER TO WEIGHT RATIOS ARE
ESTIMATED FOR SOLAR CELLS IN A FIVE YEAR
GEOSTATIONARY MISSION BEGINNING IN 1975. THE STUDY
COVERS CELL THICKNESSES FROM 125 MICROMETERS TO 300
MICROMETERS, COVERSIP THICKNESSES FROM 25
MICROMETERS TO 300 MICROMETERS, AND REAR SHIELDING
TYPICAL OF RIGID AND LIGHTWEIGHT FLEXIBLE ARRAYS.
IT IS CONCLUDED THAT THE THINNEST CELLS AND
SHIELDING GIVE THE BEST POWER TO WEIGHT RATIO,
ALTHOUGH THE CHOICE FOR A PARTICULAR SPACECRAFT WILL
BE INFLUENCED BY CONSIDERATIONS OF AVAILABILITY,
COST, FRAGILITY AND ARRAY AREA. (AUTHOR,

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 774 592 10/2 18/8
BOEING CO SEATTLE WASH

REAL-TIME SPACE AND NUCLEAR EFFECTS ON
SOLAR CELLS (ACCELERATED EVALUATION
METHODS).

(U)

DESCRIPTIVE NOTE: INTERIM TECHNICAL REPT. NO. 2, 17 MAY
72-17 MAY 73,

OCT 73 113P HORNE, WILLIAM E. ; MADARAS,

BARBARA K. ;

REPT. NO. D180-10491-3

CONTRACT: F33615-71-C-1583

PROJ: AF-3145

MONITOR: AFAPL

TR-72-69-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO AV-749 477.

DESCRIPTORS: *SOLAR CELLS, *RADIATION EFFECTS,
SILICON, LITHIUM, DOPING, DAMAGE, ANNEALING,
ELECTRON IRRADIATION, PROTON BOMBARDMENT,
ACCELERATED TESTING, MATHEMATICAL MODELS

(U)

THE REPORT DISCUSSES EXPLORATORY TESTING AND DATA
ANALYSES. A PROPOSED MODEL FOR THE ANNEALING OF
LITHIUM SOLAR CELLS IS PRESENTED. IN ADDITION, NEW
DATA SHOWING THE ENERGY DEPENDENCE OF PROTON AND
ELECTRON DAMAGE IN LITHIUM-DOPED SILICON AND THE
ANNEALING OF SUCH DAMAGE ARE PRESENTED. NEW DATA
ALSO INDICATE THAT SIMULTANEOUS IRRADIATIONS WITH
PROTONS AND ELECTRONS PRODUCE SYNERGISTIC EFFECTS.
THESE EFFECTS MAY PRODUCT EITHER MORE OR LESS
DAMAGE THAN THE SUM OF THE SEPARATE ENVIRONMENT
DEPENDING ON THE RELATIVE ELECTRON-TO-PROTON
FLUENCES. (MODIFIED AUTHOR ABSTRACT)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 776 171 10/2 20/12
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

SOLAR ELEMENTS BASED ON EPITAXIAL GAAS
FILMS.

(U)

JAN 74 6P KARGIN, M. B. ; KAROLEVA, N.
S. ; NULLER, T. P. ;
REPT. NO. FSTC-HT-23-1802-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF GELIOTEKNIKA (USSR) N2
P28-31 1970.

DESCRIPTORS: *SOLAR CELLS, *SEMICONDUCTING FILMS,
*GALLIUM ARSENIDES, THIN FILMS, ELECTRICAL
PROPERTIES, PHOTOELECTRIC EFFECT, TRANSLATIONS,
USSR

(U)

IN RECENT YEARS, THE EFFORTS OF MANY INVESTIGATORS
HAVE BEEN DIRECTED AT THE DEVELOPMENT OF THIN-FILM
POLYCRYSTALLINE SOLAR CELLS (S.C.), WHICH, IN
COMPARISON WITH MONOCRYSTALLINE S.C. HAVE A BETTER
RATIO OF OUTPUT TO POWER-WEIGHT PV(W/KG) AND A
MUCH LOWER COST. THE AUTHORS OBTAINED AND
INVESTIGATED THE PRINCIPAL CHARACTERISTICS OF S.C.
BASED ON EPITAXIAL FILMS OF GALLIUM ARSENIDE, WHICH
POSSESS THE MAXIMUM VALUE FOR LIMITING EFFICIENCY FOR
THE SOLAR SPECTRUM AND ALSO ARE CHARACTERIZED BY THE
BEST (IN COMPARISON WITH OTHER MATERIALS)
TEMPERATURE RELATIONSHIPS OF ITS PARAMETERS.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 776 551 10/2
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

HETEROGENEOUS SOLAR CONVERTERS BASED ON
POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE,

(U)

NOV 73 IIP KOMASHCHENKO, V. N. ;
MARCHENKO, A. I. ; FEDORUS, G. A. ;
REPT. NO. FSTC-HT-23-1083-72

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF POLUPROVODNIKOVAYA
TEKHNIKA I MIKROELEKTRONIKA (USSR) N4 P112-121.

DESCRIPTORS: *SOLAR CELLS, *SEMICONDUCTOR DEVICES,
CADMIUM SULFIDES, CADMIUM SELENIDES,
MANUFACTURING, PHOTOCONDUCTIVITY, ELECTRICAL
PROPERTIES, TRANSLATIONS, USSR

(U)

HETEROGENEOUS SOLAR CONVERTERS BASED ON
POLYCRYSTALLINE CADMIUM SULFIDE AND SELENIDE--
TRANSLATION.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 777 139 20/12 7/4 10/2
NATIONAL CENTER FOR ENERGY MANAGEMENT AND POWER
PHILADELPHIA PA

REVIEW AND EVALUATION OF WORK PERFORMED ON
ORGANIC SEMICONDUCTOR SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUL 72-30 JUN 73,
JUL 73 69P NOEL, GERALD T. ;
CONTRACT: F19628-72-C-0270
PROJ: AF-8659
TASK: 865901
MONITOR: AFCRL TR-73-0699

UNCLASSIFIED REPORT

DESCRIPTORS: *PHOTOVOLTAIC EFFECT, *SEMICONDUCTORS,
*SOLAR CELLS, ORGANIC COMPOUNDS, ELECTRON
TRANSITIONS, EXCITONS, IONIZATION, BAND THEORY OF
SOLIDS, ABSORPTION(PHYSICAL), PHOTONS,
CRYSTALS

(U)

IDENTIFIERS: *ORGANIC SEMICONDUCTORS

(U)

THE REPORT REVIEWS EXPERIMENTAL AND THEORETICAL
STUDIES RELATED TO THE PHOTOVOLTAIC EFFECT IN ORGANIC
SEMICONDUCTORS. PROCESSES RELEVANT TO THE
OPERATION AND PERFORMANCE OF ORGANIC SOLAR CELLS ARE
OUTLINED AND DISCUSSED IN THE CONTEXT OF A BLOCK
DIAGRAM TYPE MODEL OF AN ORGANIC PHOTOVOLTAIC DEVICE.
A DETAILED DISCUSSION OF THE IMPACT OF PHOTON
ABSORPTION AND CARRIER GENERATION PROCESSES ON THE
ULTIMATE PERFORMANCE OF SOLAR CELLS USING ORGANIC
SEMICONDUCTOR MATERIALS IS PRESENTED.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 777 473 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

THE RAE LIGHTWEIGHT SOLAR ARRAY. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
FER 74 17P TREBLE, F. C. ;
REPT. NO. RAE-TR-73172
MONITOR: DRIC BR-39317

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: PRESENTED AT THE INTERNATIONAL
CONGRESS 'THE SUN IN THE SERVICE OF MANKIND',
PARIS, 2-6 JUL 73.

DESCRIPTORS: *SOLAR CELLS, *SPACECRAFT COMPONENTS,
ARRAYS, SILICON, LIGHTWEIGHT, FOLDING,
FLEXIBLE STRUCTURES, GREAT BRITAIN (U)
IDENTIFIERS: SOLAR ARRAYS (U)

THE PAPER TRACES THE DEVELOPMENT OF THE RAE
LIGHTWEIGHT FLEXIBLE FOLD-UP SOLAR ARRAY,
CULMINATING IN THE RECENT SUCCESSFUL TESTS ON A
280W PROTOTYPE WHICH HAVE QUALIFIED THE DESIGN FOR
6 YEARS IN GEOSTATIONARY ORBIT. THE ARRAY EMBODIES
A NUMBER OF UNIQUE FEATURES, INCLUDING 125
MICROMETERS SILICON SOLAR CELLS WITH WRAPAROUND
CONTACTS, 100 MICROMETERS CERIA-STABILIZED GLASS
COVERSLIPS, CEMENTLESS MOUNTING OF CELLS ON THE
FLEXIBLE SUBSTRATE AND DEPLOYMENT BY A PNEUMATICALLY
ACTUATED TELESCOPIC MAST. A SMALL VERSION OF THE
ARRAY IS TO BE FLOWN ON THE BRITISH X4 SATELLITE
IN 1974. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 781 926 10/2
BOSTON COLL CHESTNUT HILL MASS DEPT OF PHYSICS

INVESTIGATION OF ORGANIC SEMICONDUCTOR FOR
PHOTOVOLTAIC APPLICATION.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUL 70-31 DEC 73,
APR 74 44P FANG, PAO-HSEIN ;

CONTRACT: F19628-71-C-0093

PROJ: AF-8659

TASK: 865901

MONITOR: AFCRL

TR-74-0192

UNCLASSIFIED REPORT

DESCRIPTORS: *SEMICONDUCTORS, *ORGANIC COMPOUNDS,
*PHOTOVOLTAIC EFFECT, *SOLAR CELLS, MEASUREMENT,
AGING(MATERIALS), TRANSPORT PROPERTIES,
MATHEMATICAL MODELS, ELECTRODES, METALS
IDENTIFIERS: *NAPHTHACENES, *ORGANIC

(U)

SEMICONDUCTORS

(U)

THE WORK IS ORIENTED TOWARD FIVE AREAS: (1) MEASUREMENT OF THE PHOTOVOLTAIC CONVERSION EFFICIENCY AS A SOLAR CELL, (2) ANALYSIS OF THE SPECTRAL RESPONSE OF THE QUANTUM YIELD, (3) ANALYSIS OF THE TRANSIENT RESPONSE WITH A PULSED LIGHT SOURCE, (4) MODEL ANALYSIS OF THE CONFIGURATION OF THE ORGANIC SEMICONDUCTOR SOLAR CELL AND (5) THE AGING PHENOMENON OF TETRACENE SOLAR CELLS. THE WORK IN AREAS (1) TO (4) IS COMPLETED TOGETHER WITH PHYSICAL INTERPRETATIONS. AREA (5), WHICH REQUIRES MEASUREMENTS OVER AN EXTENDED PERIOD OF TIME, BUT IS OF FUNDAMENTAL IMPORTANCE FROM THE POINT OF VIEW OF PRACTICAL APPLICATION, HAS NOT BEEN ABLE TO BE COMPLETED BEFORE THE TERMINATION OF THE PRESENT CONTRACT, AND A STAGE OF PHYSICAL INTERPRETATION HAS NOT BEEN REACHED. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 801 717 10/2
LOCKHEED MISSILES AND SPACE CO PALO ALTO CALIF
RADIATION EFFECTS IN SILICON SOLAR CELLS. PART II,

(U)

DEC 58 28P JUNG, FRANK A. ; ENSLOW,
GEORGE M. ;
REPT. NO. LMSD-48351
CONTRACT: AF 04(647)-97

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO PART I REPT. NO. LMSD-
5137 DATED 15 OCT 58, AD-477 592.

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), (*SILICON, SOLAR
CELLS), GAMMA RAYS, NEUTRONS, SATELLITES(ARTIFICIAL),
THERMAL RADIATION, PHOTOELECTRIC EFFECT, COMPTON
SCATTERING, ANNEALING, X RAYS, SPECIAL
FUNCTIONS(MATHEMATICAL), ABSORPTION, DENSITY,
(U)DENSITY

(U)

CALCULATIONS HAVE BEEN PERFORMED TO ESTIMATE THE
NUMBER OF ATOMS DISPLACED FROM NORMAL SITES BY
COMPTON ELECTRONS FROM CO(60) GAMMA RAYS AND BY
SLOW AND FAST NEUTRONS. THE RESULTANT CHANGE IN
CARRIER LIFETIMES AND MOBILITIES ARE USED TO PREDICT
THE PERFORMANCE OF A SILICON SOLAR CELL UNDER GAMMA
AND NEUTRON IRRADIATION. THE EFFECT OF ANNEALING
OF DEFECTS IS CONSIDERED, AND FROM THESE COMPUTATIONS
AN ESTIMATE IS MADE TO SHOW THE MINIMUM FLUX
NECESSARY TO PRODUCE NOTICEABLE DAMAGE. DATA ARE
PRESENTED SHOWING THE EFFECTS OF CO(60) GAMMA RAYS
ON 10 SILICON SOLAR CELLS AND COMPARISON IS MADE WITH
THE THEORY. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- A04 977 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 3, 1 JUL-1
OCT 66,

OCT 66 17P HARDING, W. R. , JR;
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DESIGN), CIRCUIT
INTERCONNECTIONS, INTERRUPTERS, FREQUENCY MULTIPLIERS,
SILICON, INTEGRATED CIRCUITS (U)

AN INTEGRATED CELL WAS FABRICATED WITH SERIES
INTERCONNECTION. THE PROBLEMS INHERENT IN THIS
STRUCTURE ARE DISCUSSED. THESE PROBLEMS WERE
LATERAL RESISTANCE AND ISOLATION JUNCTION LEAKAGE
UNDER ILLUMINATION. TECHNIQUES OF JUNCTION
FABRICATION ARE DISCUSSED. A WORKING CIRCUIT FOR
CHOPPING A MULTIPLYING SOLAR CELL OUTPUT TO 1000
VOLTS IS DISCUSSED. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 805 407 10/2.
ION PHYSICS CORP BURLINGTON MASS

ION IMPLANTATION JUNCTION TECHNIQUES. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.
3, 1 AUG-31 OCT 66.
OCT 66 42P KING, W. J. ; BURRILL, J.
T. ; SMITH, D. ; HARRISON, S. ; SOLOMON, S. J. ;

CONTRACT: AF 33(615)-3636

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, SILICON), MANUFACTURING, (U)
POWER, WEIGHT, COSTS, FILMS, THICKNESS
IDENTIFIERS: ION IMPLANTATION, THIN FILMS (U)

THE PROGRAM IS PRIMARILY DIRECTED AT THE
FABRICATION OF HIGH POWER-TO-WEIGHT RATIO CELLS WITH
INTEGRAL COVERSLEPS. DURING THIS QUARTER
INVESTIGATIONS WERE CONCENTRATED ON CONVENTIONAL
SILICON MATERIAL CELLS. AT A NOMINAL THICKNESS OF
8 MILS (WITHOUT COVERSLEIP), EFFICIENCIES AS HIGH
AS 10.3% (AMO) AND P/W RATIOS OF 121 WATTS/LB
HAVE BEEN ACHIEVED. AT 5 MILS, THE RESPECTIVE
NUMBERS ARE 9.5% AND 181 WATTS/LB. EIGHT MIL
CELLS WITH 1.5 INTEGRAL COVERSLEPS WERE MADE WITH
EFFICIENCIES OF 12.3% (TUNGSTEN - 2800 K) AND
P/W RATIOS OF 130 WATTS/LB (TUNGSTEN). (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- A07 711 10/2 11/6
RCA LABS PRINCETON N J

ADVANCED THIN-FILM SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 16 NOV 65-15 NOV 66,
JAN 67 53P CROSSLEY, PETER A. ; NOEL,
GERALD T. ; PERKINS, DAVID M. ; HUI, WILLIAM L.
C. ; BRODTMAN, KARL ;
CONTRACT: AF 33(615)-3486
PROJ: AF-8173
TASK: 817301
MONITOR: AFAPL TR-67-4

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *SEMICONDUCTING FILMS),
GALLIUM ARSENIDES, TRANSPORT PROPERTIES, SUBSTRATES,
MASS SPECTROSCOPY, CAPACITANCE, PREPARATION, PROCESSING,
LABORATORY FURNACES, IMPURITIES, STABILITY, OXIDES (U)
IDENTIFIERS: ANTIREFLECTION COATINGS, THIN FILMS, THIN
FILM ELECTRONICS (U)

DURING THIS CONTRACT THIN-FILM GAAS SOLAR CELLS
USING SEMITRANSSPARENT PT LAYERS AS THE BARRIER
CONTACT HAVE BEEN MADE AND INVESTIGATED TO IMPROVE
THEIR PHOTOVOLTAIC CHARACTERISTICS. STUDIES OF THE
GAAS FILM, GROWN BY THE OXIDE TRANSPORT PROCESS,
AND THE BARRIER CONTACT STRUCTURE, CONSISTING OF THE
PT FILM, GRIDGING, AND ANTIREFLECTION COATING, LED
TO THE FABRICATION OF A CELL OF 2-SQ CM ACTIVE AREA
WITH AN EFFICIENCY OF 3.77 PERCENT UNDER TUNGSTEN
LIGHT GIVING AN I(SC) VALUE EQUIVALENT TO THAT OF
1/100 MW SQ CM AIR MASS 1 SUNLIGHT. THE CELL
FABRICATION METHODS WHICH WERE DEVELOPED RESULTED IN
CELLS THAT EXHIBITED NO DEGRADATION UNDER ROOM
AMBIENT. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 809 143 10/2
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV
FLEXIBLE INTEGRATED SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 7, 1 DEC 66-1
MAR 67,
MAR 67 33P DUPONT, PRESTON S. ;
SUENAGA, EJI L. ; BURNELL, P. ;
REPT. NO. SSD-70123R
CONTRACT: AF 33(615)-2750
PROJ: AF-8173
TASK: 81730-007

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR CELLS, CONFIGURATION),
ENVIRONMENTAL TESTS, TEST METHODS, ACOUSTICS, VIBRATION,
SOLAR PANELS, TEMPERATURE, TUNGSTEN,
FRACTURE(MECHANICS), GLASS, ALUMINUM, SHOCK(MECHANICS),
NOISE (U)
IDENTIFIERS: TITAN 3 (U)

THE SEVENTH QUARTER ACTIVITY DESCRIBED IN THIS
REPORT CONSISTS OF THE UPGRADING OF THE MECHANICAL
MODEL IN PREPARATION FOR THE TITAN III VIBRATION
AND ACOUSTIC NOISE TESTS. SP8B, AN ADVANCED
(SOLDERLESS) SOLAR CELL ARRAY, COMPLETE WITH
COVERGLASSES, HAS BEEN ASSEMBLED, SUNLIGHT TESTED AT
TABLE MOUNTAIN, AND INTEGRATED INTO THE
MECHANICAL MODEL DUMMY SOLAR PANEL. SP8A, AN
EARLIER SOLAR ARRAY, HAS ALSO BEEN PATCHED INTO THE
DUMMY SOLAR PANEL. EFFICIENCY TESTS AT TABLE
MOUNTAIN WERE CONDUCTED ON DRIFT-FIELD SOLAR CELLS.
SPECTRAL RESPONSE TESTS HAVE BEEN RUN ON THE
VARIOUS TYPES OF SOLAR CELLS USED IN THE FISCA
PROGRAM. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 813 447 10/2 9/5
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 5, 1 JAN-31
MAR 67,
MAR 67 32P HARDING, W. R. , JR;
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, INTEGRATED CIRCUITS),
(*SEMICONDUCTING FILMS, MANUFACTURING), CRYSTALLIZATION,
MASKING, ION ENGINES, SILICON, EVAPORATION, DEPOSITION,
IMPURITIES, DOPING, SURFACE PROPERTIES, FEASIBILITY
STUDIES, OXIDES, PHOSPHORUS, LEAKAGE(ELECTRICAL),
INFRARED SPECTROSCOPY, ETCHING, ELECTRICAL RESISTANCE,
DIFFUSION (U)
IDENTIFIERS: FABRICATION, METALLIZATION, NEAR INFRARED
REGION (U)

A SOLUTION TO THE PROBLEM OF LATERAL ISOLATION OF A
SERIES STRING MONOLITHIC SOLAR CELL IS PRESENTED.
THE STRUCTURE PRODUCED CELLS WITH OUTPUT VOLTAGES
OF 2 VOLTS V MAX AND 7.3% CONVERSION EFFICIENCY
UNDER AM=0, 140 MW/SQ CM ILLUMINATION. GOOD
CURVE FACTORS AND OUTPUTS WERE DEMONSTRATED INDICATING
THE FEASIBILITY OF INTERNAL, MONOLITHIC ISOLATION AND
INTERCONNECTION. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOMC7

AD- 815 664 10/2

HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

FLEXIBLE INTEGRATED SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 8, 2 MAR-1 JUN 67,

JUN 67 84P DUPONT, PRESTON S. ; BALLEW, L. ; SUENAGA, EIJI L. ; THOMAS, H. ; TERKUN, V. ;

REPT. NO. SSD-70268R

CONTRACT: AF 33(615)-2750

PROJ: AF-8173

TASK: 81730

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, ENVIRONMENTAL TESTS), MODEL TESTS, HUMIDITY, CONFIGURATION, VIBRATION, VISUAL INSPECTION, NOISE, INTENSITY, TEMPERATURE, STORAGE, WEIGHT, REDUCTION (U)

IDENTIFIERS: ARRAYS, SOLAR CELLS, SUNLIGHT (U)

THE EIGHTH QUARTER ACTIVITY DESCRIBED IN THIS REPORT INCLUDED THE COMPLETION OF ENVIRONMENTAL TESTS ON THE FISCA MECHANICAL MODEL, PRELIMINARY QUALIFICATION TESTS ON CONVENTIONAL 2 X 2 CM CELL ARRAY SEGMENTS, HUMIDITY TESTS ON THE SP-1E DENDRITIC CELL ARRAY SEGMENT, AND EFFICIENCY MEASUREMENTS FOR A SAMPLE OF DRIFT-FIELD DENDRITIC CELLS. THREE CANDIDATE DESIGNS WERE ALSO COMPLETED FOR FISCA FLIGHT UNITS. THE MECHANICAL MODEL SUCCESSFULLY PASSED BOTH A VIBRATION AND AN ACOUSTIC NOISE TEST AT TITAN IIIC QUALIFICATION LEVELS. SAMPLE ARRAY SEGMENTS, FABRICATED USING 4 AND 8 MIL THICK, 2 X 2 CM CELLS, ALSO PASSED A TITAN IIIC VIBRATION TEST. A VISUAL INSPECTION AFTER 400 HOURS OF HIGH HUMIDITY EXPOSURE AT ELEVATED TEMPERATURES REVEALED NO DAMAGE TO THE SP-1E ARRAY. ELECTRICAL PERFORMANCE TEST RESULTS ARE NOT YET AVAILABLE. SUNLIGHT PERFORMANCE MEASUREMENTS WERE CONDUCTED AT TABLE MOUNTAIN FOR A SAMPLE OF DENDRITIC DRIFT-FIELD CELLS. A DRIFT-FIELD PRIMARY STANDARD WAS USED AS A REFERENCE. CONVERSION EFFICIENCIES AS HIGH AS 11 PERCENT (AMO, 140 MW/SQ CM, 25 C, 90 PERCENT ACTIVE AREA FACTOR) WERE MEASURED. BASED ON THE CONVENTION OF NOT EXCLUDING COLLECTOR GRIDS FROM THE ACTIVE AREA, THE PEAK EFFICIENCY MEASURED WAS 10.6 PERCENT (I.E., 93 PERCENT ACTIVE AREA FACTOR, AMO, 140 MW/SQ CM, 25 C). (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 817 614 10/2
ION PHYSICS CORP BURLINGTON MASS

THIN SILICON SOLAR CELLS BY ION IMPLANTATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. 25 JAN 66-27 JUN 67,
JUL 67 70P BURRILL, J. T. ; STIRRUP, K.

CONTRACT: AF 33(615)-3636
MONITOR: AFAPL TR-67-83

UNCLASSIFIED REPORT

DESCRIPTORS: (•SOLAR CELLS, SILICON), DENDRITIC
STRUCTURE, INFRARED SPECTRA, ACCELERATION, DAMAGE,
RADIATION EFFECTS, HANDLING, CERAMIC COATINGS, SURFACE
PROPERTIES, CRYSTAL STRUCTURE (U)
IDENTIFIERS: SEMICONDUCTOR JUNCTIONS (U)

THE REPORT DESCRIBES INVESTIGATIONS PERFORMED OVER
A 17 MONTH PERIOD ON THE FABRICATION OF THIN N-ON-P
SILICON CELLS USING THE ION IMPLANTATION TECHNIQUE.
INVESTIGATIONS CONDUCTED UNDER THIS PROGRAM
REPRESENT AN EXTENSION OF INVESTIGATIONS CONDUCTED ON
CONTRACT AF33(615)-2292 AND PRECEDING
CONTRACTS. WORK ON DENDRITIC MATERIAL DEMONSTRATED
THAT CELL QUALITY IS ALMOST COMPLETELY DETERMINED BY
THE STARTING MATERIAL. ALTHOUGH MATERIAL OF THE
HIGHEST QUALITY WAS NOT AVAILABLE FOR USE ON THIS
CONTRACT, CELLS WITH AMO EFFICIENCIES OF GREATER
THAN 9.48 AND POWER-TO-WEIGHT RATIOS OF GREATER
THAN 100 WATTS/LB WERE FABRICATED. THESE VALUES
WERE ACHIEVED ON CELLS WHICH HAD THE DENDRITES LEFT
ON TO PROVIDE STRUCTURAL RIGIDITY AND FORM PART OF
THE ACTIVE AREA. WORK ON CONVENTIONAL MATERIAL HAS
DEMONSTRATED THE FEASIBILITY OF FABRICATING SILICON
SOLAR CELLS USING A REFLECTING BACK CONFIGURATION.
THE USE OF THIS CONTACT WILL ALLOW THINNER, MORE
RADIATION RESISTANT CELLS TO BE FABRICATED WITH
HIGHER EFFICIENCIES DUE TO THE SECOND PASS OF THE
INCIDENT RADIATION THROUGH THE CELL AND THUS AN
INCREASED ABSORPTION PATH NEARER THE JUNCTIONS.
CELLS DOWN TO 0.004 INCH HAVE BEEN FABRICATED,
USING THIS TECHNIQUE, WHICH SHOWED IMPROVED
EFFICIENCIES UNDER BOTH TUNGSTEN AND AMO
CONDITIONS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 818 310 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 6, 1 APR-30
JUN 67,

JUN 67 21P NOWALK, T. P. I
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR CELLS, MANUFACTURING), SILICON
COATINGS, FREQUENCY MULTIPLIERS, DESIGN, INTERRUPTERS,
TUNGSTEN, VOLTAGE CONTROLLED OSCILLATORS (U)

THIS REPORT COVERS THE PROGRESS ON THE HIGH
VOLTAGE SOLAR CELL ARRAY SEGMENT. THE
INTERNAL INTEGRATED ISOLATION AND INTERCONNECTION
DESIGN WAS USED IN FABRICATION OF HVSC ON SILICON
WEB. A SERIES CONNECTED ARRAY OF FOUR UNCOATED
UNITS, NOT NECESSARILY ADJOINING ONE WITH THE OTHER,
YIELDED AN INTEGRATED OUTPUT OF $V_{OC} = 2.0$ VOLTS AND
5.5 EFFICIENCY UNDER 100 MW/CM SQUARED INCIDENT
TUNGSTEN LAMP RADIATION. THE CURVE FACTOR WAS
0.76. PROBLEMS ENCOUNTERED WERE SIMILAR TO THOSE
EXPERIENCED ON EQUIVALENT ARRAYS FABRICATED ON
SILICON WAFERS. THUS, FEASIBILITY OF THE DESIGN
CONCEPT HAS BEEN DEMONSTRATED ON SILICON WEB. SIZE
AND WEIGHT OF THE MULTIPLIER PORTION OF THE CONVERTER
WERE REDUCED BY A FACTOR OF FIVE BY USING
SUBMINIATURE COMPONENTS. CHOPPER OPERATION HAS
BEEN DEMONSTRATED AT A FREQUENCY OF 1 MHZ.
FINALLY, THE DEVELOPMENT OF A VOLTAGE CONTROLLED
OSCILLATOR FOR VOLTAGE REGULATION HAS BEEN INITIATED.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 819 491 10/2
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

FLEXIBLE INTEGRATED SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUN 65-31 MAY 67,
AUG 67 153P BERRY, L. B. ;BROWN, W. D.
;DAWSON, W. P. ;SUENAGA, E. L. ;

REPT. NO. SSD-70378R
CONTRACT: AF 33(615)-2750
PROJ: AF-8173
TASK: 81730-007
MONITOR: AFAPL TR-67-100

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, FLEXIBLE STRUCTURES),
(*SOLAR CELLS, AEROSPACE CRAFT), LAUNCHING, PACKAGING,
TEST METHODS, AERODYNAMICS, VIBRATION, STRESSES,
HALOCARBON PLASTICS, GLASS TEXTILES, GRAVITY,
DEFLECTION, CONFIGURATION, MANUFACTURING (U)
IDENTIFIERS: ATLAS, CENTAUR, TITAN 3 (U)

A 2-YEAR RESEARCH AND DEVELOPMENT PROGRAM FOR THE AIR FORCE WAS CONDUCTED TO ACQUIRE THE TECHNOLOGY TO DESIGN AND FABRICATE FLEXIBLE DEPLOYABLE SOLAR CELL ARRAYS THAT ADVANCED THE POWER-TO-WEIGHT RATIO OF PRESENT ARRAYS BY A FACTOR OF THREE. LARGE AREA FLEXIBLE INTEGRATED SOLAR CELL ARRAYS (FISCA) ARE CAPABLE OF COMPACT STOWAGE AND POSITIVE DEPLOYMENT AND RETRACTION. THIS REPORT PRESENTS THE FISCA DEVELOPMENT PROGRAM INCLUDING THE SUBSYSTEM DESIGN AND MECHANICAL SYSTEM TEST CERTIFICATION TO THE ATLAS/CENTAUR AND TITAN III-C LAUNCH ENVIRONMENT. THE FISCA DESIGN WAS EXTENDED TO INCLUDE LARGE AREA SOLAR ARRAYS. A 50-SQUARE-FOOT DEMONSTRATION MODEL CAPABLE OF PRODUCING 500 WATTS IN A NEAR-EARTH ORBIT WAS FABRICATED AND TESTED. TECHNIQUES FOR FABRICATING AND TESTING FLEXIBLE ARRAYS UTILIZING STANDARD 2 BY 2 CM N/P 10-0HM CM SILICON CELLS AS WELL AS 1 BY 30 CM DENDRITIC SILICON CELLS WERE EXAMINED. ALTHOUGH EITHER CELL COULD HAVE BEEN UTILIZED, THE PRIMARY EFFORT WAS FOCUSED ON INCORPORATION OF A GFP 1 BY 30 CM DENDRITIC CELL INTO THE FISCA DEMONSTRATION MODEL. PROOF OF PRINCIPLE HAS BEEN ESTABLISHED AND INDICATES THAT ARRAYS UP TO 20 KILOWATTS IN SIZE ARE ENTIRELY FEASIBLE. FUTURE EFFORT WOULD BE CENTERED AROUND DESIGN, DEVELOPMENT, AND FABRICATION OF A FLIGHT-QUALIFIED 5-KW SYSTEM HAVING A SPECIFIC MASS OF 40 LB/KW OR BETTER. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 820 279 10/2 13/8
GENERAL ELECTRIC CO LYNCHBURG VA POLYCRYSTALLINE
SEMICONDUCTOR PRODUCTS BUSINESS SECTION

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL
EFFECTS INVESTIGATION.

(U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 2, 1
JUN-31 AUG 67.

AUG 67 SOP SCHLOTTERBECK, RICHARD S. ;
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DESIGN), POWER EQUIPMENT,
MANUFACTURING, CADMIUM ALLOYS, TELLURIDES, SUBSTRATES,
MOLYBDENUM, WEIGHT, LEAKAGE (ELECTRICAL), HEAT TREATMENT,
FILMS, EFFICIENCY, DOPING, ETCHING, COPPER ALLOYS,
SOLUBILITY, PLATINUM, SINGLE CRYSTALS

(U)

IDENTIFIERS: PROTOTYPE EQUIPMENT, ARRAYS, SOLAR
CELLS

(U)

SEVERAL ONE SQUARE INCH CELLS HAVE BEEN MADE FROM
LIGHT WEIGHT MATERIAL AND 2-12 MICRON CDTE FILMS.
THESE CELLS HAD A WEIGHT-TO-AREA RATIO OF 0.022
POUNDS PER SQUARE FOOT AND A POWER-TO-WEIGHT RATIO OF
140 WATTS PER POUND. A GENERALLY NEGATIVE
EXPONENTIAL DEPENDENCE OF CELL LEAKAGE CONDUCTANCE ON
FILM THICKNESS HAS BEEN OBSERVED. INTERESTING
RESULTS HAVE BEEN NOTED ON FILMS GROWN ON MOLY
SUBSTRATES TREATED IN A WIDE VARIETY OF DIFFERENT
ETCHANTS. ONE PARTICULAR NEW SOLUTION RESULTED IN
FILMS WITH ONE-HALF TO ONE-THIRD THE LEAKAGE
CONDUCTANCE OF FILMS GROWN ON SUBSTRATES ETCHED BY
THE STANDARD SULFATE SOLUTION. SEVERAL PROTOTYPE
DESIGNS OF A SINGLE-FEED BOILER ARE BEING EVALUATED.
FURTHER STUDIES OF SINGLE VS. DOUBLE TREATMENT,
INTERMEDIATE HEAT TREATMENT, DIP TIME AND SOLUTION
CONCENTRATION HAVE RESULTED IN REFINEMENTS OF THE
CU(+) BARRIER FORMATION PROCESS. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 822 426 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

DENDRITIC SILICON SOLAR CELL OPTIMIZATION AND
FABRICATION.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 2 AUG 65-14 APR 67,
OCT 67 42P MERRITS, T. D. IERNICK, N.

ICHIKAWA, Y. ;

CONTRACT: AF 33(615)-3223

PROJ: AF-8173

TASK: 817301

MONITOR: AFAPL TR-67-101

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *SILICON), (*DENDRITIC
STRUCTURE, SOLAR CELLS), WEIGHT, REDUCTION, TUNGSTEN,
SPECIFICATIONS, THICKNESS, INTENSITY, TEMPERATURE,
DIFFUSION, EPITAXIAL GROWTH, SUBSTRATES, DAMAGE,
RADIATION EFFECTS, SPECTROPHOTOMETERS, SPUTTERING,
OPTIMIZATION, COATINGS, QUARTZ, SILVER COMPOUNDS,
TITANIUM

(U)

THIS REPORT DESCRIBES THE RESEARCH AND DEVELOPMENT
WORK TO OPTIMIZE AND FABRICATE DENDRITIC SILICON
SOLAR CELLS IN THE AREAS RELATED TO WEIGHT REDUCTION,
PHYSICAL AND ELECTRICAL CHARACTERISTICS, AND
RADIATION RESISTANCE. A TOTAL OF 970 DIFFUSED
STANDARD CELLS AND 901 EPITAXIAL DRIFT FIELD CELLS OF
1 BY 30.5 CM SIZE WERE FABRICATED. THE EFFICIENCY
RANGE OF THE STANDARD CELLS WAS 9.0 TO 13.3 PERCENT
WITH A MEAN OF 10.5 PERCENT, AND THE RANGE OF THE
DRIFT FIELD CELLS WAS 9.0 TO 12.7 PERCENT WITH A MEAN
OF 10.6 PERCENT. THE CELL EFFICIENCIES ARE BASED
ON TUNGSTEN 100 MW/SQ CM. PHYSICAL AND ELECTRICAL
PROPERTIES BASED ON TYPICAL CELL CHARACTERISTICS
RELATED TO ILLUMINATION INTENSITY, SPECTRAL RESPONSE,
TEMPERATURE, AND RADIATION RESISTANCE ARE GIVEN.
PROCESS SPECIFICATIONS FOR CELL FABRICATION ARE
INCLUDED. INTEGRAL QUARTZ COATINGS OF AT LEAST
.001 INCH THICKNESS WERE EVALUATED AND ARE DISCUSSED
BRIEFLY.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 822 428 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT. (U)

DESCRIPTIVE NOTE: INTERIM PROGRESS REPT. NO. 7, 1 JUL-30
SEP 67,

SEP 67 32P NOWALK, T. P. ;
CONTRACT: AF 33(615)-3462

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, SILICON), (*SOLAR CELLS,
SILICON), VOLTAGE REGULATORS, PROCESSING, MASKING,
DIFFUSION, VOLTAGE, EPITAXIAL GROWTH, DOPING, DENDRITIC
STRUCTURE, OXIDATION, POWER AMPLIFIERS, PULSE AMPLIFI(U)
IDENTIFIERS: ISOLATORS(ELECTRONICS), MULTIVIBRATORS,
PHOTORESIST TECHNIQUES, VOLTAGE MULTIPLIERS (U)

THIS REPORT COVERS THE PROGRESS ON THE HIGH
VOLTAGE SOLAR CELL ARRAY SEGMENT.
PROCESSING OF TWELVE INCH LONG SILICON WEB WAS
PERFORMED. A NUMBER OF MODIFICATIONS RELATED TO
THE PHOTOMASKING AND ISOLATION DIFFUSION STEPS WERE
INTRODUCED WHICH MADE THIS POSSIBLE. THE LONGEST
CELL TESTED CONSISTED OF A 43-UNIT CONTIGUOUS ARRAY
WHICH YIELDED VOC = 19.7 VOLTS, ISC = 5.5 MA AND
PM = 71.4 MW UNDER 100 SQ CM TUNGSTEN LIGHTS.
EFFICIENCY IN THE UNCOATED STATE WAS 3.9% --
EQUIVALENT TO AN ESTIMATED 5% COATED CELL.
THUS THE PROGRAM CONCEPT OF THE HIGH VOLTAGE SOLAR
CELL HAS BEEN EXTENDED TO PHYSICAL LENGTHS UP TO
TWELVE INCHES, AND DEVICES HAVE BEEN TESTED IN ARRAYS
WHICH EXCEED SEVEN INCHES IN LENGTH. A POWER
CONDITIONING NETWORK CAPABLE OF CONVERTING 50 VDC TO
1000 VDC WITH A 10 WATT POWER CAPABILITY HAS BEEN
DEVELOPED USING VOLTAGE MULTIPLIER TECHNIQUES.
SYSTEM EFFICIENCY AT FULL LOAD IS APPROXIMATELY
75%. BETTER THAN 5% VOLTAGE REGULATION IS
OBTAINED FOR LOADS RANGING FROM 10% OF FULL LOAD TO
FULL LOAD. A RATING OF 46 WATTS/LB IS OBTAINED
WITH PROTOTYPE BREADBOARD CIRCUIT. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 825 455 10/2
GENERAL ELECTRIC CO LYNCHBURG VA POLYCRYSTALLINE
SEMICONDUCTOR PRODUCTS BUSINESS SECTION

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL
EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 3, 1
SEP-30 NOV 67,
DEC 67 80P SCHLOTTERBECK, RICHARD S. I
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

DESCRIPTORS: (SOLAR CELLS, EFFICIENCY), CADMIUM,
TELLURIUM, SILVER, COPPER, SCIENTIFIC RESEARCH,
PLATINUM, PROCESSING, PHOSPHORUS, STABILITY,
PREPARATION, PERFORMANCE(ENGINEERING), ENVIRONMENTAL
TESTS (U)

A SIMPLE AND QUICK PROCEDURE FOR PREPARING AND
TESTING CDTE: CU2TE SOLAR CELLS MADE FROM
SINGLE CRYSTALLINE CDTE IS DESCRIBED. THIS NEW
TECHNIQUE WILL REDUCE THE OVERALL TIME FACTOR FOR
DEVICE PREPARATION AND TEST AND THEREBY INCREASE THE
EFFICIENCY OF RESEARCH INVESTIGATIONS. THE APPLIED
RESEARCH PROGRAM WAS DIRECTED TO STUDIES OF THE
EFFECTS OF SUBSTRATE ETCHING AND PHOSPHORUS DOPING ON
CELL PERFORMANCE. IT HAS BEEN SHOWN THAT THE
FERRICYANIDE ETCH OF THE MOLY SUBSTRATE RESULTS IN
HIGH QUALITY CDTE FILM, WHICH, ON THE AVERAGE,
PRODUCES HIGHER EFFICIENCY (E.G. 4.58 VS. 4.18)
AND LESS 'LEAKY' CELLS THAN FILM GROWN ON ACID
TREATED SUBSTRATES. A COMPARISON BETWEEN
PHOSPHORUS AND COPPER AS ACCEPTOR DOPANTS IN THE
CDTE FILM SHOWED THAT THE LATTER ELEMENT WAS
SUPERIOR IN TERMS OF CELL ISC AND EFFICIENCY.
EFFICIENCIES IN THE RANGE OF 4.58 TO 5.58 HAVE
BECOME FAIRLY COMMON FOR 1 SQ. IN. CELLS. WITH
LARGER AREAS (1 IN. X 4 IN.), THE VALUES ARE
SOMEWHAT LOWER, NAMELY 3.58 TO 5.08. SCANNING
OF THE LARGER AREAS IN 1 CM2 'CELL UNITS' HAS CLEARLY
SHOWN THAT MANY PORTIONS OF THE LARGER AREA ARE OVER
5.08 EFFICIENCY. IT IS BELIEVED THAT FURTHER
REFINEMENTS IN THE FILM GROWING PROCESS, RATHER THAN
THE CHOICE OF DOPANTS, IS THE KEY TO ACHIEVING CELL
EFFICIENCIES GREATER THAN THE 58 LEVEL THAT HAS
BEEN DEMONSTRATED IN THE WORK OF THIS QUARTER.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 828 769 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA

HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 3 JAN 66-15 NOV 67,
NOV 67 110P NOWALK, T. F. HAJEK, G.

D. ;

CONTRACT: AF 33(615)-3462

PROJ: AF-3145

TASK: 314519

MONITOR: AFAPL TR-68-1

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, FEASIBILITY STUDIES),
MANUFACTURING, MICROELECTRONICS,
PERFORMANCE(ENGINEERING), INTEGRATED CIRCUITS,
ELECTRICAL PROPERTIES, SILICON, SOLAR CELLS, DC TO DC
CONVERTERS (U)

IDENTIFIERS: ELECTRICAL LOADING, ION PROPULSION,
SEMICONDUCTOR JUNCTIONS (U)

THE FINAL REPORT SUMMARIZES THE ENTIRE DEVELOPMENT PROGRAM CONDUCTED BY THE WESTINGHOUSE ELECTRIC CORPORATION IN WHICH FEASIBILITY OF FABRICATING HIGH VOLTAGE SOLAR CELL ARRAYS ON 1 CM X 30 CM SILICON WEB WAS DEMONSTRATED, AND A POWER CONDITIONING NETWORK FOR CONVERSION OF 50 VDC TO 1000 VDC WITH A 10 WATT POWER CAPABILITY WAS DEVELOPED USING VOLTAGE MULTIPLIER TECHNIQUES. THE HIGH VOLTAGE SOLAR CELL ARRAY SEGMENT WAS DESIGNED ABOUT A DIFFUSED ISOLATION AND INTERCONNECT STRUCTURE, THE ANALOGUE OF A SERIES ARRAY OF MORE THAN SIXTY INDIVIDUAL CELLS IN THE WELL-KNOWN SHINGLED CONFIGURATION. FABRICATION OF THE MONOLITHIC STRUCTURE REQUIRED DEVELOPMENT OF NEW TECHNIQUES FOR HANDLING TWELVE-INCH PIECES OF SILICON, NOTABLY IN DIFFUSION AND PHOTOMASKING OPERATIONS. THE RESULTANT HIGH VOLTAGE CELLS WERE CHARACTERIZED BY OPEN CIRCUIT VOLTAGES OF 30 VOLTS, SHORT CIRCUIT CURRENTS OF 7 TO 8 MA AND EFFICIENCIES UP TO 7.3% UNDER 100 MA/SQ CM, AM1, TUNGSTEN RADIATION. THUS, THE FINAL SAMPLES DELIVERED TO THE AIR FORCE DEMONSTRATE THE FEASIBILITY OF BUILDING HIGH VOLTAGE SOLAR CELL ARRAY SEGMENTS IN MONOLITHIC STRUCTURES AS PER CONTRACT EXPECTATIONS. THE CELL DESIGN, FABRICATION PROCESS AND TEST RESULTS ARE REVIEWED IN THIS REPORT. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 831 536 10/2
GENERAL ELECTRIC CO LYNCHBURG VA

IMPROVED COTE SOLAR CELL AND ARRAY ENVIRONMENTAL
EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 4, 1 DEC 67-29
FEB 68,

MAR 68 SSP SCHLOTTERBECK, RICHARD S. I
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, CADMIUM COMPOUNDS), (*SOLAR
PANELS, CADMIUM COMPOUNDS), TELLURIDES, FILMS,
SUBSTRATES, MOLYBDENUM, COPPER, CADMIUM SULFIDES,
ADHESION, ELECTRON DIFFRACTION, MICROSCOPY, TRACER
STUDIES, EFFICIENCY, GOLD, ENVIRONMENTAL TESTS (U)
IDENTIFIERS: *CADMIUM TELLURIDE, THIN FILMS (U)

BASIC MATERIALS RESEARCH HAS BEEN CONDUCTED IN FOUR
GENERAL AREAS AS FOLLOWS: ELECTRON DIFFRACTION
AND OPTICAL MICROSCOPY STUDIES, QUANTUM EFFICIENCY
MEASUREMENTS VERSUS WAVELENGTH UNDER OPERATING
CONDITIONS, DEGRADATION TESTS UNDER CONTROLLED
AMBIENT CONDITIONS AND DIFFUSION AND SOLUBILITY
MEASUREMENTS USING RADIOACTIVE COPPER. A MAXIMUM
EFFICIENCY OF 5.58 (SUNLIGHT INTO ELECTRIC POWER,
AMI) WAS CALCULATED ON THE BASIS OF THE SPECTRAL
RESPONSE AND I-V CHARACTERISTIC OF A FRESH,
'BARE' SINGLE CRYSTAL CELL. EFFICIENCIES GREATER
THAN 6.58 WOULD BE EXPECTED AFTER ALLOWANCES FOR
CELL AREA COVERED BY THE CONTACT AND THE USE OF
LACQUER AS AN ANTI-REFLECTANCE COATING. A
FUNDAMENTAL STUDY OF THE REACTIONS WHICH MAY BE
TAKING PLACE ON THE SUBSTRATE HAS BEEN STARTED.
RESULTS ARE REPORTED ON THE BEHAVIOR OF BOTH
PLATINUM BARRIER AND COPPER BARRIER CELLS IN A
VARIETY OF ENVIRONMENTS. EFFICIENCIES OF 5.58 ON
ONE SQUARE INCH CELLS HAVE BEEN OBSERVED WITH NO
MEASURABLE DETERIORATION AT ROOM TEMPERATURE/DRY AIR
OR, IN AIR AT 79% R. H. AREA SCANNING
TECHNIQUES ON 60 SQUARE INCHES OF GROWN FILM HAVE
DISCLOSED APPROXIMATELY ONE SQUARE INCH AREAS WITH
EFFICIENCIES AS HIGH AS 5.8%. MODIFICATIONS IN
THE GOLD GRIDDING TECHNIQUE AND EVAPORATION CYCLE
HAVE RESULTED IN SIGNIFICANTLY HIGHER CELL EFFICIENCY
DISTRIBUTIONS. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 831 824 10/2 13/8
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

INVESTIGATION OF LARGE AREA DENDRITIC WEB TYPE
GERMANIUM PHOTOVOLTAIC CELLS.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 15 JUL 66-29 DEC 67,
APR 68 72P ERNICK, N. ; MERRITTS, T. D.

; WEHRLI, H. A. ;

CONTRACT: DA-28-043-AMC-02350(E)

PROJ: DA-1TO-14501-A34A

MONITOR: ECOM 02350-F

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DESIGN), MANUFACTURING,
GERMANIUM, CRYSTAL GROWTH, ELECTRICAL RESISTANCE,
DIFFUSION, GALLIUM, SOLAR PANELS, FEASIBILITY STUDIES,
PERFORMANCE(ENGINEERING), EFFICIENCY, VOLTAGE, ELECTRIC
CURRENTS (U)

THIS FINAL REPORT DESCRIBES THE DEVELOPMENT OF A
LARGE-AREA THERMOPHOTOVOLTAIC CELL MADE ON GERMANIUM
WEB. THE WEB GROWTH PROCESS IS DISCUSSED,
INCLUDING THE MODIFICATIONS NECESSARY FOR GROWTH OF
N-TYPE WEB OF RESISTIVITY AS LOW AS 0.004 OHM-CM.
DEVICES UTILIZING EITHER FRONT OR BACK JUNCTIONS,
AND PREPARED EITHER BY ALLOYING OR BY DIFFUSION, WERE
PREPARED. OF THESE DEVICES, THE GALLIUM-DIFFUSED
FRONT JUNCTION TYPE SHOWED MOST PROMISE AS A
THERMOPHOTOVOLTAIC POWER GENERATOR. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 836 612 10/2 13/8
GENERAL ELECTRIC CO LYNCHBURG VA POLYCRYSTALLINE
SEMICONDUCTOR PRODUCTS BUSINESS SECTION

IMPROVED CDTE SOLAR CELL AND ARRAY ENVIRONMENTAL
EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 5. 1
MAR-31 MAY 68,
MAY 68 106P SCHLOTTERBECK, RICHARD S. ;
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY TECHNICAL REPT. NO.
3. AD-825 455.

DESCRIPTORS: (*SOLAR CELLS, MANUFACTURING), CADMIUM
COMPOUNDS, TELLURIDES, ENVIRONMENTAL TESTS, EFFICIENCY,
STABILITY, TEST METHODS, MATHEMATICAL MODELS,
CORRELATION TECHNIQUES, METALLOGRAPHY, SPACE SIMULATION
CHAMBERS (U)
IDENTIFIERS: CADMIUM TELLURIDE, GRAPHS(CHARTS) (U)

WORK ON THE BASIC PHYSICS AND CHEMISTRY OF THE
CU₂TE-CDTE SYSTEM AS WELL AS MEANS FOR
DEFINING THE PROPER MEASURING AND EVALUATION
PROCEDURES OF ACTUAL CELLS ARE PRESENTED IN DETAIL.
SIGNIFICANT CONTRIBUTIONS TOWARDS IMPROVEMENT IN
UNDERSTANDING THE MORE FUNDAMENTAL ASPECTS OF THE
CDTE SOLAR CELL WERE MADE IN THE FOLLOWING
AREAS: USE OF OPTICAL MICROSCOPIC TECHNIQUES IN
ASCERTAINING THE 'METALLOGRAPHY' OF THE FILM CELLS;
ELECTRON DIFFRACTION STUDIES, MAINTENANCE TESTS, AND
DIFFUSION AND SOLUBILITY MEASUREMENTS OF COPPER IN
CDTE; AND, SOLAR CELL SPECTRAL RESPONSE
MEASUREMENTS. EXTENSIVE STUDIES HAVE ALSO BEEN
MADE ON THE EFFECTS ON FILM AND SOLAR CELL
CHARACTERISTICS OF THREE MAJOR VARIABLES IN THE FILM
GROWTH PROCESS: CONTINUAL CUCL FEED; EFFECT ON
NET DONOR CONCENTRATION OF CUCL FEED RATE; AND,
EFFECT ON NET DONOR CONCENTRATIONS OF VARIATIONS IN
PUMPING SPEED. THE COMBINED EFFECTS OF THE
CUCL POWDER FLOW RATE AND THE MEASURED REACTOR
PRESSURES HAVE ESTABLISHED AN EMPIRICAL RELATIONSHIP
BETWEEN THOSE VARIABLES AND THE NET IMPURITY DENSITY
(ND-NA). A NUMBER OF CELL CHARACTERISTICS
HAVE BEEN SUCCESSFULLY CORRELATED WITH (ND-NA),
AND THE CORRELATION QUALITATIVELY ACCOUNTED FOR BY A
PROPOSED THEORETICAL DEVICE MODEL. (AUTHOR) (U)

UNCLASSIFIED

DOC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 836 663 22/2
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

ORIENTATION LINKAGE FOR A SOLAR CELL ARRAY: OL
SCA.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 1 JUL 67-30 JUN 68,
JUL 68 283R TURNER, WILLIAM N. ; OLSON,

WERLE C. ;

REPT. NO. SSD-80221R

CONTRACT: F33615-67-C-1785

PROJ: AF-3145

TASK: 314519

MONITOR: AFAPL TR-68-76

UNCLASSIFIED REPORT

DESCRIPTORS: (*SATELLITES(ARTIFICIAL), ATTITUDE CONTROL
SYSTEMS), (*ATTITUDE CONTROL SYSTEMS, *SOLAR CELLS),
LUBRICATION, MOMENTUM, SUN, DETECTORS, LIFE EXPECTANCY,
FEASIBILITY STUDIES, DESIGN (U)

A 12-MONTH PROGRAM WAS CONDUCTED TO DEVELOP THE
TECHNOLOGY FOR ACTIVELY ORIENTING 1/2- TO 20-KW
SOLAR-CELL ARRAYS ON ACTIVELY AND PASSIVELY
STABILIZED EARTH-ORIENTED SATELLITES WITH MISSION
LIFETIMES OF 3 TO 5 YEARS. A DETAILED DESIGN FOR
LINKAGE CAPABLE OF CARRYING A 5-KW ARRAY WAS
DEVELOPED. CONSIDERATION OF THE GENERAL DESIGN
REQUIREMENTS LED TO SPECIFICATION OF A TWO-DEGREE-OF-
FREEDOM GEARLESS MECHANISM INCORPORATING SUN SENSING,
DIRECT SHAFT TORQUING, AND POWER TRANSFER BY
SLIPRING/BRUSH ASSEMBLIES. LOAD CONDITIONS AND
LIFE REQUIREMENTS ALLOWED INCORPORATION OF DRY-
LUBRICATION TECHNIQUES THROUGHOUT. IT IS SHOWN
THAT SPECIFICATION OF RELATIVELY SHORT SUN-
ACQUISITION TIMES FOR THIS TYPE OF SYSTEM PENALIZES
THE DESIGN UNNECESSARILY. IN THE GENERAL CASE, THE
MISSION VEHICLE'S CONTROL SYSTEM SHOULD INCLUDE AN
ADEQUATE ANGULAR-MOMENTUM STORAGE DEVICE AS WELL AS
REACTION-JET ATTITUDE CONTROLS. THE RESIDUAL
ATMOSPHERE PRECLUDES OPERATING FOR ANY APPRECIABLE
PERIOD IN ORBITS BELOW 400 N. MI. ALTITUDE.
SATISFACTORY PERFORMANCE OF DRY, SELF-LUBRICATING
COMPOSITES WAS DEMONSTRATED FOR BEARING LUBRICATION
AND FOR MOTOR, POWER, AND SIGNAL TRANSFER BRUSHES.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 847 127 10/2 13/8
GENERAL ELECTRIC CO SYRACUSE N Y SPECIAL INFORMATION
PRODUCTS DEPT

IMPROVED CDTE SOLAR CELL AND ARRAY
ENVIRONMENTAL EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL PROGRESS REPT. NO.
6. 1 JUN-31 AUG 68,
SEP 68 28P ALDRICH, R. W. ; MARPLE, D.
T. F. ;
CONTRACT: F33615-67-C-1485

UNCLASSIFIED REPORT

DESCRIPTORS: (*CADMIUM COMPOUNDS, SOLAR CELLS), (*SOLAR
CELLS, MANUFACTURING), TELLURIDES, COPPER COMPOUNDS,
CRYSTAL GROWTH, ULTRAVIOLET SPECTRA, VISIBLE SPECTRA,
RESPONSE(BIOLOGY), CALIBRATION, DEPOSITION, EVAPORATION,
GOLD, PHOSPHORUS, CRYSTAL DEFECTS, SEMICONDUCTING FILMS,
SOLAR PANELS (U)
IDENTIFIERS: CADMIUM TELLURIDES, HETEROJUNCTIONS,
SEMICONDUCTOR JUNCTIONS (U)

THE OUTPUT VOLTAGE OF CUZTE:CDTE
HETEROJUNCTION CELLS MIGHT BE IMPROVED BY USING
INSTEAD A PN HOMOJUNCTION, A METAL:SEMICONDUCTOR
BARRIER, OR SOME OTHER TYPE OF HETEROJUNCTION.
DURING THE PRESENT QUARTER PHOSPHORUS DIFFUSION HAS
BEEN USED TO FORM SHALLOW PN HOMOJUNCTIONS. SOME
PHOTORESPONSE WAS NOTED, BUT SEVERE CURRENT LIMITING
WAS EXPERIENCED DUE TO HIGH P-REGION SHEET
RESISTIVITY. ALSO RE-EXAMINED WAS GOLD:CDTE
BARRIERS, FORMED BY BOTH EVAPORATION AND ELECTROLESS
DEPOSITION. ONE EVAPORATED GOLD CELL YIELDED
UNUSUALLY HIGH OPEN-CIRCUIT VOLTAGE (680 MV), BUT
CURRENT (AND EFFICIENCY) WERE RELATIVELY LOW.
WORK ON SHORT-CIRCUIT CURRENT IMPROVEMENT CHIEFLY
INVOLVED IMPROVING THE AREA UTILIZATION FACTOR FROM
ABOUT 89% TO 95%, USING BETTER EVAPORATION MASKS
AND HOLD-DOWN TECHNIQUES. AN ATTEMPT WAS MADE TO
GAIN EXTRINSIC ABSORPTION OF LIGHT BY GROWING
CDSE(x)TE(1-x) MIXED CRYSTAL FILMS, BUT
NO INCREASE IN CURRENT WAS NOTED. TWO METHODS FOR
CALCULATING SHORT-CIRCUIT CURRENTS AND EFFICIENCIES
FROM SPECTRAL RESPONSE DATA ARE GIVEN. A NON-
LINEAR RELATIONSHIP BETWEEN OUTPUT CURRENT AND
ILLUMINATION INTENSITY IN THIN FILM CELLS WAS NOTED
AND A METHOD FOR TAKING THIS INTO ACCOUNT IN
EFFICIENCY CALCULATIONS IS GIVEN. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 850 354 10/2 13/13
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

LARGE RETRACTABLE SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 3, 27
DEC 68-23 MAR 69,

APR 69 68P WOLFF, GEORGE ; FELKEL, EDWARD

O. ;

REPT. NO. SSD-90112R

CONTRACT: F33615-68-C-1676

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY TECHNICAL REPT.
NO. 2, AD-845 768.

DESCRIPTORS: (*SOLAR PANELS, *EXTENDABLE STRUCTURES),
SOLAR CELLS, POWER SUPPLIES, BOOMS(EQUIPMENT),
EXPERIMENTAL DESIGN, FLIGHT TESTING, ENVIRONMENTAL
TESTS, RELIABILITY (U)

IDENTIFIERS: *LRSCA(LARGE RETRACTABLE SOLAR CELL
ARRAY) (U)

THE MAIN ACTIVITY ON THE LARGE RETRACTABLE
SOLAR CELL ARRAY (LRSCA) PROGRAM DURING THE
THIRD QUARTERLY REPORTING PERIOD CONSISTED OF THE
COMPLETION OF THE ANALYSIS OF A MAJORITY OF THE MAJOR
SUBSYSTEM COMPONENTS, START OF DETAILED DRAWINGS,
COMPLETION OF THE PRELIMINARY QUALIFICATION MODEL
DESIGN AND TEST SPECIFICATION, EMC GUIDELINES,
FAILURE MODES AND EFFECTS ANALYSIS, MAINTAINABILITY
AND RELIABILITY ANALYSIS, AS WELL AS COMPLETION OF
THE SOLAR ARRAY TEST BED. DETAILED DESIGN REVIEWS
WERE ALSO HELD DURING THIS PERIOD ON THE SOLAR ARRAY,
SOLAR ARRAY STORAGE DRUM AND MECHANISM, AND THE
ORIENTATION LINKAGE MECHANISM AND CONTROL
ELECTRONICS. TEST AND DEVELOPMENT ACTIVITY
CONSISTED OF TEST VERIFICATION OF SUBSYSTEM ELEMENTS,
SUCH AS THE BOOM LENGTH COMPENSATOR MECHANISM, CELL
AND SUBSTRATE MATERIAL PROCESSES, AS WELL AS THE
PERFORMANCE OF PANEL TENSION TESTS AT ROOM
TEMPERATURE. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 852 760 10/2
GENERAL ELECTRIC CO SYRACUSE N Y SEMICONDUCTOR PRODUCTS
DEPT

IMPROVED COTE SOLAR CELL AND ARRAY
ENVIRONMENTAL EFFECTS INVESTIGATION. (U)

DESCRIPTIVE NOTE: FINAL REPT. 1 MAR 67-1 MAY 69,
MAY 69 125P DENEVE, R. J. ;ALDRICH, R.
W. ;BLAKE, F. A. ;KRAPP, R. N. ;MARPLE, D.
T. F. ;

CONTRACT: F33615-67-C-1485
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-69-32

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *CADMIUM COMPOUNDS),
(*SEMICONDUCTING FILMS, *VAPOR PLATING), (*SOLAR PANELS,
ENVIRONMENTAL TESTS), TELLURIDES, COPPER, DEGRADATION,
HUMIDITY, CADMIUM SULFIDES, INFLATABLE STRUCTURES,
EXPANDED PLASTICS, ISOCYANATE PLASTICS, WORK FUNCTIONS,
EPITAXIAL GROWTH, SUBSTRATES, ADHESION, INTERFACES (U)
IDENTIFIERS: CADMIUM TELLURIDES (U)

WORK ON VAPOR-REACTED THIN-FILM COTE SOLAR
CELLS IS REPORTED. DEVELOPMENT OF THE BASIC FILM
GROWTH PROCESSING AND CELL FABRICATION IS SUMMARIZED.
A GENERAL DESCRIPTION OF THE VAPOR REACTION PROCESS
FOR GROWING THIN COTE FILM ON A MOLYBDENUM
SUBSTRATE, AS IT WAS USED AT THE BEGINNING OF 1967,
IS GIVEN. AMONG THE MAJOR PROBLEMS WORKED ON WERE
WEIGHT REDUCTION, ADHERENCE OF FILM TO SUBSTRATE,
ELECTRICAL CONTACTS, STABILITY, AND EFFICIENCY.
THE RESULTS OF STABILITY TESTS ARE REPORTED, AND
MEASUREMENT OF EFFICIENCY AND FACTORS AFFECTING IT
ARE DISCUSSED. A RE-EXAMINATION OF METAL:
SEMICONDUCTOR BARRIERS RESULTED IN A SUCCESSFUL
EFFORT TO BUILD GOLD SCHOTTKY BARRIER CELLS DURING
THE FINAL FOUR MONTHS OF THE CONTRACT. FILM GROWTH
PARAMETERS AND PROCESSING METHODS WERE EXAMINED, AND
EFFICIENCY RESULTS OBTAINED WITH GOLD BARRIER CELLS
ARE REPORTED. TECHNIQUES FOR PRODUCING AN
INFLATABLE ARRAY OF THIN-FILM SOLAR CELLS WERE
STUDIED. METHODS FOR CALCULATING SHORT CIRCUIT
CURRENT FROM SPECTRAL RESPONSE DATA AND FOR
DETERMINING AM-1 AND AM-0 SOLAR CELL EFFICIENCIES
FROM MEASUREMENTS UNDER TUNGSTEN RADIATION ARE GIVEN (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 854 941 10/2 13/13
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

LARGE RETRACTABLE SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY TECHNICAL REPT. NO. 4, 24

MAR-29 JUN 69,

JUL 69 60P

FELKEL, EDWARD O. ; WOLFF,

GEORGE ;

REPT. NO. SSD-90240R

CONTRACT: F33615-68-C-1676

PROJ: AF-682J

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY TECHNICAL REPT.
NO. 3, AD-250 354.

DESCRIPTORS: (*SOLAR PANELS, *EXTENDABLE STRUCTURES),
SOLAR CELLS, POWER SUPPLIES, BOOMS(EQUIPMENT),
EXPERIMENTAL DESIGN, FLIGHT TESTING, ENVIRONMENTAL
TESTS, RELIABILITY (U)

IDENTIFIERS: *LRSCA(LARGE RETRACTABLE SOLAR CELL
ARRAY) (U)

PRESENTED ARE DETAILED DRAWINGS OF THE ORIENTATION
MECHANISM IN CORPORATION OF REFERENCE SOLAR CELL AND
SOLAR CELL MODULES OF 8 AND 12-MIL CELLS IN THE SOLAR
PANEL DESIGN, DETAIL DRAWINGS OF THE DRUM MECHANISM
AND SOLAR ARRAY, AND ALL ELECTRONIC CIRCUIT DETAIL
DESIGN. BREADBOARDS OF THE SOLAR PANEL SWITCH AND
CHARGE CURRENT CONTROLLER WERE BUILT AND TESTED OVER
ANTICIPATED ORBITAL TEMPERATURE EXTREMES. (U)

(AUTHOR)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 860 179 10/2 22/2
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE SYSTEMS DIV

LARGE RETRACTABLE SOLAR CELL ARRAY. (U)

DESCRIPTIVE NOTE: QUARTERLY REPT. NO. 5, 30 JUN-28 SEP
69,

OCT 69 62P FELKEL, EDWARD O. ; WOLFF,
GEORGE ; OLSON, M. C. ; TURNER, W. N. ; DANIEL,
R. E. ;

REPT. NO. SSD-90364R
CONTRACT: F33615-68-C-1676
PROJ: AF-682J

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO QUARTERLY TECHNICAL REPT.
NO. 4, AD-854-941.

DESCRIPTORS: (*SOLAR PANELS, EXTENDABLE STRUCTURES),
SOLAR CELLS, POWER SUPPLIES, BOOMS(EQUIPMENT), CONTROL
SYSTEMS, CIRCUITS, INVERTERS, TELEMETER SYSTEMS,
ENVIRONMENTAL TESTS, ELECTRIC MOTORS, DESIGN,
RELIABILITY, SPECIFICATIONS, LAUNCH VEHICLES, INTERFA(U)
IDENTIFIERS: AGENA, LARGE RETRACTABLE SOLAR CELL
ARRAYS (U)

THE MAIN ACTIVITIES ON THE LARGE RETRACTABLE
SOLAR CELL ARRAY(LRSCA) PROGRAM DURING THE
FIFTH QUARTERLY REPORTING PERIOD CONSISTED OF
COMPLETION OF THE DETAILED DRAWINGS OF THE SOLAR
ARRAY, DRUM MECHANISM, AND CONTROL ELECTRONICS UNIT
(CEU). CIRCUIT DESIGN OF THE TWO-PHASE, 400 HZ
POWER SUPPLY FOR THE EXTENSION/RETRACTION MOTOR HAS
BEEN COMPLETED. BREADBOARDS OF THE BOOST/ADD
INVERTER, THE 10 KHZ INVERTER, AND THE
INSTRUMENTATION CONDITIONING UNIT (ICU) HAVE BEEN
BUILT AND FUNCTIONALLY TESTED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 867 390 9/1 10/2 20/12
FOREIGN TECHNOLOGY DIV WRIGHT-PATTERSON AFB OHIO

GALLIUM-ARSENIDE PHOTOELECTRIC RECEIVING
DEVICES, (U)

FEB 70 21P KORWIN-PAWLOWSKI, MICHAL ;
REPT. NO. FTD-HT-23-658-69
PROJ: FTD-6040102

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: EDITED TRANS. OF PRZEGLAD
ELEKTRONIKI (POLAND) VIO N3 P105-114 1969, BY L.
MAROKUS.

DESCRIPTORS: (*PHOTODIODES, GALLIUM ARSENIDES), (*SOLAR
CELLS, GALLIUM ARSENIDES), (*VARIABLE RESISTORS, GALLIUM
ARSENIDES), PHOTOELECTRIC CELLS(SEMICONDUCTOR),
PHOTOCONDUCTIVITY, DAMAGE, RADIATION EFFECTS, SPACE
ENVIRONMENTS, ALPHA PARTICLE DETECTORS, POLAND (U)
IDENTIFIERS: *PHOTORESISTORS, TRANSLATIONS (U)

A REVIEW OF THE STATE OF THE ART IN GALIUM ARSENIDE
PHOTOELECTRIC DEVICES FOR RADIATION DETECTION AND
ENERGY CONVERSION IS MADE, BASED ON RECENT FOREIGN
PUBLICATIONS. THE CONSTRUCTION, FABRICATION
TECHNIQUES AND PRO PERTIES OF VARIOUS KINDS OF
PHOTORESISTORS, PHOTODIODES AND SOLAR CELLS MADE OF
GAAS ARE DESCRIBED. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 867 832 11/2 10/2
TEM-PRES RESEARCH/CARBORUNDUM STATE COLLEGE PA

HYDROGEN-IMPREGNATED GLASS COVERS FOR
HARDENED SOLAR CELLS. (U)

DESCRIPTIVE NOTE: TECHNICAL REPT. 15 NOV 68-15 JAN 70,
MAR 70 59P FAILE, SAMUEL P. HARDING,

WILLIAM R. ;

CONTRACT: F33615-69-C-1221

PROJ: AF-3145

TASK: 314519

MONITOR: AFAPL TR-70-12

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, GLASS), (*GLASS, DAMAGE),
HARDENING, IMPREGNATION, HYDROGEN, PROTECTION, COLORS,
COLOR CENTERS, (U)COLOR CENTERS (U)
IDENTIFIERS: RADIATION HARDENING (U)

THE REPORT SUMMARIZES THE ENTIRE DEVELOPMENT
PROGRAM CONDUCTED BY TEM-PRES RESEARCH/
CARBORUNDUM WHICH EXPERIMENTALLY DEMONSTRATED THAT
HYDROGEN IMPREGNATION WILL SIGNIFICANTLY REDUCE
DARKENING OF SOLAR CELL GLASS COVERS UNDER SOLAR,
NUCLEAR, AND VAN ALLEN BELT RADIATION CONDITIONS,
AND THAT THIS TECHNIQUE CAN BE PRACTICALLY APPLIED TO
HARDENED SOLAR CELL ARRAYS ON FUTURE ORBITAL
VEHICLES. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 869 460 10/2 18/8
WESTINGHOUSE RESEARCH LABS PITTSBURGH PA

SOLAR CELL NEUTRON DAMAGE
INVESTIGATION.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 1 OCT 68-6 FEB 70;
MAY 70 146P HICKS, JOHN M. ;
CONTRACT: F33615-68-C-1616
PROJ: AF-3145
MONITOR: AFAPL TR-70-24

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, *DAMAGE), SILICON, EPITAXIAL
GROWTH, FAST NEUTRONS, EFFICIENCY, DEGRADATION,
(U)DEGRADATION

(U)

MULTI-LAYER SILICON SOLAR CELLS OFFER THE
POSSIBILITY OF NUCLEAR RADIATION RESISTANCE GREATER
THAN THAT OF CONVENTIONAL STATE-OF-ART SINGLE
JUNCTION SILICON SOLAR CELLS. EPITAXIALLY-
FABRICATED SPECIMENS WERE PREPARED AND STUDIED FOR
THEIR PERFORMANCE UNDER FAST NEUTRON IRRADIATION.
SEVERAL MULTILAYER SPECIMENS PLUS CONVENTIONAL
STATE-OF-ART N/P SPECIMENS WERE EXPOSED TO NEAR-
FISSION SPECTRUM NEUTRONS. THE AIR MASS ZERO POWER
CONVERSION CHARACTERISTICS WERE EVALUATED DURING
INTERRUPTIONS IN THE BOMBARDMENT. EFFICIENCIES OF
PRE-PROTOTYPE UNCOATED SPECIMENS WERE AS HIGH AS
6%, AND MONOTONICALLY DECREASED WITH INCREASES IN
FLUENCE. SIMILAR DEGRADATION WAS OBSERVED IN THE
SHORT-CIRCUIT CURRENT OF THE SPECIMENS. THE
EFFICIENCIES AND SHORT CIRCUIT CURRENTS AT ALL
FLUENCE VALUES WERE LESS THAN EXPECTED ON THE BASIS
OF COMPUTER MODELING STUDIES. AT THE PRESENT TIME,
THE PREMATURE DEGRADATION IS ATTRIBUTED TO ARTIFACTS
IN THE DEVELOPMENTAL CELLS. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 875 751 10/2
WESTINGHOUSE ELECTRIC CORP YOUNGWOOD PA SEMICONDUCTOR
DIV

SILICON CELL LIFETIME AND EFFICIENCY
IMPROVEMENT.

(U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 15 DEC 68-15
FEB 70,

SEP 70 288P JOHNSON, JOSEPH E. , JR. ;
DAVIS, JOHN RANSFORD ; RAI-CHOUDBURY, P. ;
BARRETT, DONALD L. ;
CONTRACT: F33615-68-C-1189
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-70-30

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, LIFE EXPECTANCY),
PERFORMANCE(ENGINEERING), SEMICONDUCTOR DEVICES,
SILICON, TEST METHODS, EPITAXIAL GROWTH, MANUFACTURING,
DAMAGE, RADIATION EFFECTS, ELECTRON IRRADIATION,
SIMULATION (U)

IDENTIFIERS: ANALOG SIMULATION, CARRIER RECOMBINATION,
COMPUTER AIDED DESIGN, COMPUTERIZED SIMULATION,
MINORITY CARRIERS, RADIATION HARDENING (U)

THE LOSS THROUGH RECOMBINATION OF MINORITY CARRIERS
GENERATED DEEP WITHIN A SILICON SOLAR CELL IS A
LIMITATION ON THE EFFICIENCY AND RADIATION RESISTANCE
OF PRESENT DEVICES. IN THIS WORK THE AUTHORS HAVE
EXPLORED THE POTENTIAL OF MULTIJUNCTION SILICON SOLAR
CELLS PREPARED BY DIFFUSION AND EPITAXIAL TECHNIQUES
FOR IMPROVED EFFICIENCY AND RADIATION RESISTANCE.
TWO-JUNCTION DIFFUSED CELL STRUCTURES WERE FOUND TO
OFFER IMPROVED PERFORMANCE FOR VERY THIN WAFERS.
(AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 913 278 10/2 18/8
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

NEUTRON IRRADIATION TEST OF EXPERIMENTAL
SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: PROGRESS REPT.,
JUL 73 48P GRIFFEN, NEIL C. WALLIS,
ALBERT E. ;
REPT. NO. AFAPL-TR-73-58
PROJ: AF-3145
TASK: 314519

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR CELLS, DAMAGE), (*SILICON, SOLAR
CELLS), NEUTRONS, NUCLEAR EXPLOSION DAMAGE, MILITARY
SATELLITES, NUCLEAR RADIATION, HARDENING, DEGRADATION,
LITHIUM, DOPING, ANNEALING, TEMPERATURE, NEUTRON FLUX,
STABILITY, EFFICIENCY, TABLES(DATA), GRAPHICS,
(U)GRAPHICS

(U)

NINETY-SEVEN SILICON SOLAR CELLS OF 3 DIFFERENT
TYPES WERE EXPOSED TO 5 DIFFERENT NEUTRON FLUENCE
LEVELS BETWEEN 1.72×10 TO THE 11TH POWER AND $2.47 \times$
 10 TO THE 13TH POWER NEUTRONS/SQ CM (1 MEV
EQUIVALENT) IN THE WHITE SANDS MISSILE
RANGE EAST BURST REACTOR AND THEN ALLOWED TO
ANNEAL AT TEMPERATURES OF 25, 60 AND 80 C FOR
APPROXIMATELY 1000 HOURS. PRE AND POST-EXPOSURE
MEASUREMENTS WERE TAKEN TO DETERMINE THE AMOUNT OF
DEGRADATION DUE TO NEUTRON EXPOSURE AND THE RATE AND
EXTENT TO WHICH THE DAMAGE ANNEALED. THE THREE
TYPES OF SPECIMENS INCLUDED THE EXPERIMENTAL, SUPER-
VIOLET, SILICON CELLS RECENTLY DEVELOPED BY THE
COMSAT LABORATORIES, STATE-OF-THE-ART LITHIUM-
DOPED SILICON CELLS, AND EXPERIMENTAL BARRIER-LAYER,
LITHIUM-DOPED SILICON CELLS. THIS REPORT DOCUMENTS
THE TEST PROCEDURES AND RESULTS OF THE EXPERIMENT.
THE COMSAT CELLS HAD THE HIGHEST PRE-EXPOSURE
EFFICIENCIES BUT AFTER EXPOSURE THE LITHIUM-DOPED
CELLS ANNEALED TO SIGNIFICANTLY HIGHER EFFICIENCIES.
THE BARRIER-LAYER CELLS HAD LOW INITIAL
EFFICIENCIES AND WERE UNSTABLE. EXTENSIVE DATA
TAKEN ON THE CELLS IS ON FILE AND MAY BE MADE
AVAILABLE FOR FURTHER STUDIES AND ANALYSES.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD- 919 085 10/2 18/6 22/2
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

AN EVALUATION OF A SPACE FLIGHT TEST OF
HARDENED SOLAR ARRAY TECHNOLOGY.

(U)

DESCRIPTIVE NOTE: FINAL PROJECT REPT. 15 JAN 72-15 APR
73,

MAR 74 79P GREEN, JOHN M. ;
REPT. NO. AFAPL-TR-73-106
PROJ: AF-3145
TASK: 314519

UNCLASSIFIED REPORT

DESCRIPTORS: (*SOLAR PANELS, *RADIATION
HARDENING), (*SOLAR CELLS, ARRAYS), NAVIGATION
SATELLITES, FLIGHT TESTING, TEST METHODS,
TELEMETERING DATA, TEMPERATURE, INTENSITY,
VOLTAGE, DIRECT CURRENT, ULTRASONIC WELDING,
HONEYCOMB CORES, BONDING, ALUMINUM, LITHIUM,
DOPING, COORDINATES, TRANSFORMATIONS, TITANIUM,
SILVER

(U)

IDENTIFIERS: TRANSIT

(U)

ON 2 SEPTEMBER 1972, THE NAVY LAUNCHED A
NAVIGATIONAL SATELLITE OF THE TRANSIT SERIES.
THIS SATELLITE, WHICH WAS CALLED TRIAD DURING ITS
DEVELOPMENT, HAS A RADIOISOTOPE THERMAL GENERATOR
(RTG) FOR ITS MAIN POWER SOURCE; HOWEVER, IT HAS AN
AUXILIARY POWER SOURCE CONSISTING OF FOUR
EXPERIMENTAL HARDENED SOLAR PANEL SEGMENTS. ANOTHER
ONE OF THE EXPERIMENTS ON BOARD THE SPACECRAFT IS A
SET OF SIX SOLAR CELL MODULES DESIGNATED THE
ENVIRONMENTAL SURVEY PANEL (ESP). THIS
REPORT WILL DESCRIBE THE PRE-FLIGHT TESTS THAT WERE
CONDUCTED ON THE SOLAR POWER EXPERIMENTS, THE RESULTS
OF THOSE TESTS, AND THE FLIGHT DATA THAT ARE
AVAILABLE.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A000 451 10/2 18/8 22/2
PHILCO-FORD CORP PALO ALTO CALIF WESTERN DEVELOPMENT LABS
DIV

REAL TIME ASSESSMENT OF IMPROVED LITHIUM-
DOPED SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: FINAL REPT.,
JUL 74 228P BRIGGS, DONALD C. ; POLLARD,
HOWARD E. ; PETERSON, DARRYL G. ;
CONTRACT: F33615-73-C-2016
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-74-55

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SOLAR CELLS, *RADIATION EFFECTS,
SILICON, LITHIUM, DOPING, ELECTRON IRRADIATION,
NEUTRONS, STRONTIUM, ISOTOPES, NUCLEAR
EXPLOSIONS, SPACECRAFT COMPONENTS, REAL TIME (U)

LITHIUM-DOPED SILICON SOLAR CELLS WERE IRRADIATED AT AN ACCELERATED REAL-TIME RATE, WITH A STRONTIUM-90 RADIOISOTOPE SIMULATING THE TRAPPED ELECTRON ENVIRONMENT. THE IRRADIATION WAS PERFORMED FOR A ONE-YEAR PERIOD IN A SIMULATED SPACE ENVIRONMENT. THREE ADVANCED TYPES OF LITHIUM CELLS AND TWO TYPES OF CONVENTIONAL N/P CELLS WERE CONTROLLED TO TEMPERATURES TYPICAL OF NORMAL ORIENTED SOLAR ARRAY SATELLITE OPERATIONAL CONDITIONS. AT THE SIX-MONTH POINT, THE CELLS WERE EXPOSED TO A PULSED NEUTRON ENVIRONMENT SIMULATING A NUCLEAR WEAPON DETONATION. THE EXPERIMENT WAS SUCCESSFUL IN PROVIDING HIGH QUALITY DATA CHARACTERIZING THE COMPARATIVE PERFORMANCE OF SEVERAL SOLAR CELL TYPES. THE EXPERIMENTAL PROGRAM DEMONSTRATED THE ADVANTAGES OBTAINED BY USING RECENT PRODUCTION LITHIUM-DOPED SOLAR CELLS FOR SPACECRAFT MISSIONS REQUIRING NUCLEAR HARDENING. THE FEASIBILITY OF DESIGNING AND PRODUCING SOLAR ARRAYS USING ALUMINUM CONTACT LITHIUM-DOPED SOLAR CELLS HAS BEEN SHOWN TO HAVE DEFINITE ADVANTAGES FOR ARRAYS SUBJECTED TO NEUTRON ENVIRONMENTS. (MODIFIED AUTHOR ABSTRACT) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A001 084 10/2 22/2
TEXAS INSTRUMENTS INC DALLAS SEMICONDUCTOR GROUP

DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR
CELLS FOR SPACECRAFT PRIMARY POWER.

(U)

DESCRIPTIVE NOTE: TECHNICAL REPT. 1 JAN 73-31 MAR 74,
JUN 74 71P SMELTZER, RONALD K. HOTZ,
ROD F. SHAH, PRADEEP ;
REPT. NO. TI-03-74-15
CONTRACT: F33615-73-C-2019
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-74-45

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SOLAR CELLS, *SPACECRAFT COMPONENTS,
SILICON, RADIATION RESISTANCE, EPITAXIAL GROWTH,
ELECTRON BEAMS, ORIENTATION(DIRECTION),
DIFFUSION
IDENTIFIERS: DESIGN, SOLAR ARRAYS

(U)

(U)

DURING THE FIRST HALF OF THIS PROGRAM TO DEVELOP
THE VERTICAL MULTIJUNCTION SOLAR CELL, NEW SILICON
TECHNOLOGIES WERE DEVELOPED SO THAT THREE TYPES OF
2000 JUNCTION PER CM PACKING DENSITY, VERTICAL
MULTIJUNCTION SOLAR CELLS CAN BE MADE. THE NEW
TECHNOLOGIES INCLUDE: (1) LARGE AREA ELECTRON
BEAM PATTERN GENERATION, (2) ORIENTATION
DEPENDENT ETCHING, (3) EPITAXIAL SILICON REFILL
OF DEEP GROOVES, AND (4) DIFFUSION IN DEEP
GROOVES. BASED UPON THE TECHNOLOGY DEVELOPMENT
ACHIEVED AND THE PROPOSED VMJ CELL DESIGNS, TWO
TYPES OF CELLS WERE SELECTED FOR CONTINUING
DEVELOPMENT. A FEW PRELIMINARY, LOW EFFICIENCY
CELLS WERE FABRICATED. A SMALL MODELING EFFORT WAS
ALSO UNDERTAKEN TO ANSWER SPECIFIC QUESTIONS RELEVANT
TO CELL FABRICATION. BASED UPON THE RESULTS
OBTAINED DURING THIS HALF OF THE PROGRAM, THE VMJ
SOLAR CELL, ALTHOUGH REQUIRING VERY ADVANCED
FABRICATION TECHNIQUES, IS A VIABLE DEVICE FOR
SPACECRAFT POWER IN THE FUTURE. (AUTHOR)

(U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A002 339 22/2 10/2 18/8
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

THE PROSPERO SOLAR CELL EXPERIMENTS.

(U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
JUN 74 20P TREBLE, F. C. ;
REPT. NO. RAE-TR-74061
MONITOR: DRIC BR-41995

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SPACECRAFT COMPONENTS, *SOLAR CELLS,
*RADIATION EFFECTS, SILICON, CERIUM COMPOUNDS,
OXIDES, COATINGS, GREAT BRITAIN
IDENTIFIERS: PHOTOVOLTAIC CELLS, PROSPERO
SATELLITE

(U)

(U)

THE EXPERIMENTS HAVE DEMONSTRATED THE SPACE
WORTHINESS AND RADIATION RESISTANCE OF VERY THIN
FLEXIBLY-MOUNTED SILICON CELLS AND THE SUPERIORITY OF
CERIA-STABILIZED GLASS OVER FUSED SILICON AS A
COVERSLIP MATERIAL. THE ACCURACY OF PERFORMANCE
AND RADIATION DAMAGE PREDICTIONS BASED ON TERRESTRIAL
MEASUREMENTS HAS BEEN ESTABLISHED. THE BEHAVIOR OF
THE HEAVILY PRE-IRRADIATED CELLS IN THE COVERSLIP
EXPERIMENT APPEARS TO CONFIRM THE RECENTLY DISCOVERED
PHOTON DEGRADATION EFFECT IN FLOAT ZONE SILICON OF
HIGH DISLOCATION DENSITY. BUT THE EFFECT IS NOT
YET EVIDENT IN THE THIN CELLS WHICH WERE NOT PRE-
IRRADIATED.

(U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A002 846 10/2 11/2
GENERAL ELECTRIC CO PHILADELPHIA PA SPACE DIV

INTEGRAL GLASS COVERS FOR SILICON SOLAR
CELLS.

(U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT. 19 MAY 71-31

OCT 74,

OCT 74 70P RAUCH, HARRY W. , SR.;

ULRICH, DONALD R. ;

CONTRACT: F33615-71-C-1656

PROJ: AF-3145

TASK: 314519

MONITOR: AFAPL

TR-74-14

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SOLAR CELLS, *PROTECTIVE COATINGS,
*GLASS, RADIATION RESISTANCE, THERMAL EXPANSION,
LIGHT TRANSMISSION, FUSION(MELTING), SILICON

(U)

A PROGRAM OF INORGANIC GLASS DEVELOPMENT RESULTING
IN THE FORMULATION OF NUMEROUS COMPOSITIONS FOR
DIRECT FUSION TO SILICON SOLAR CELLS WAS CONDUCTED.
THE GLASSES WERE SEDIMENTED AS -200 MESH PARTICLES
ONTO THE FRONT SURFACE OF THE SOLAR CELLS, THEN
FUSED, TO FORM AN INTEGRAL COVER, AT TEMPERATURES
RANGING FROM 510C TO 600C DEPENDING ON SOLAR CELL
TYPE AND GLASS COMPOSITION. COATINGS, AT LEAST 50
MICRONS THICK, WERE APPLIED TO BOTH N/P ALUMINUM
-CONTACTED AND SILVER/TITANIUM-CONTACTED CELLS.
ELECTRICAL CHARACTERIZATION OF THE BARE AND COATED
CELLS, BEFORE AND AFTER ELECTRON IRRADIATION, SHOWS
THAT SOME CELLS CAN BE INTEGRALLY COVERED BY THIS
TECHNIQUE WITHOUT DEGRADING THEIR CONVERSION
EFFICIENCY BELOW AN ACCEPTABLE LEVEL. GLASS
PREPARATION, COMPOSITIONAL MODIFICATIONS, AND THE
EFFECT OF THESE CHANGES ON FUSION TEMPERATURE,
RADIATION RESISTANCE, TRANSMISSION, AND THERMAL
EXPANSION ARE DISCUSSED.

(U)

UNCLASSIFIED

ODC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A003 509 10/2
BOEING CO SEATTLE WASH

REAL-TIME SPACE AND NUCLEAR EFFECTS ON
SOLAR CELLS (ACCELERATED EVALUATION
METHODS), VOLUME III.

(U)

DESCRIPTIVE NOTE: FINAL REPT. MAY 71-JUL 74,
JUL 74 275P HORNE, W. E. ; GREGOR, R.
B. ; WILKINSON, M. C. ; MADARAS, B. K. ;
REPT. NO. D180-10491-4
CONTRACT: F33615-71-C-1583
MONITOR: AFAPL TR-72-69-VOL-3

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO REPORT DATED OCT 73,
AD-774 592.

DESCRIPTORS: *SOLAR CELLS, SILICON, LITHIUM,
DOPING, ACCELERATED TESTING, MODELS, DAMAGE,
SPACEBORNE, RADIATION EFFECTS, ANNEALING

(U)

A TECHNIQUE WAS DEVELOPED FOR THE ACCELERATED
EVALUATION OF SILICON SOLAR CELLS TO BE USED IN
EXTENDED SPACE MISSIONS DURING WHICH WEAPONS
ENVIRONMENTS MAY ALSO BE ENCOUNTERED. STANDARD
N/P SILICON CELLS, AS WELL AS LITHIUM-DOPED
SILICON CELLS, WERE USED AS TEST SAMPLES DURING THE
DEVELOPMENT AND VERIFICATION OF THE EVALUATION
METHOD. THE SOLAR CELL DAMAGE MODEL DEVELOPED
REPRESENTS A SIGNIFICANT ADVANCEMENT FOR PREDICTING
SPACE PERFORMANCE OF SOLAR CELLS. THE MODEL IS
CAPABLE OF (1) ACCOUNTING FOR THE SHIELDING OF
SOLAR ARRAYS, (2) INTEGRATING OVER THE SPACE
ENVIRONMENT FOR BOTH PROTONS AND ELECTRONS, (3)
CALCULATING DEFECT DENSITIES AS A FUNCTION OF
POSITION INSIDE THE SOLAR CELL, (4) CALCULATING
THE OUTPUT I-V CHARACTERISTICS OF SOLAR CELLS
UNDER A SOLAR ILLUMINATION SPECTRUM, AND (5)
ACCOUNTING FOR ANNEALING IN LITHIUM DOPED P/N
SOLAR CELLS.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-AD03 752 22/1 17/7 10/2
AEROSPACE CORP EL SEGUNDO CALIF ENGINEERING SCIENCE
OPERATIONS

SHADED SUN SENSOR MODELING FOR SPACECRAFT
ACQUISITION PERFORMANCE ANALYSIS,

(U)

NOV 74 25P WONG, K. K. ; MANKE, G. M.
; UYEMINAMI, R. T. ;
REPT. NO. TR-0075(5624-02)-1
CONTRACT: F04701-74-C-0075
MONITOR: SAMSO TR-74-261

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE:

DESCRIPTORS: *SATELLITE ATTITUDE, *SOLAR CELLS,
*SPACECRAFT COMPONENTS, MATHEMATICAL MODELS,
POSITION FINDING

(U)

IDENTIFIERS: *SOLAR SENSORS, SPACECRAFT CONTROL,
*SATELLITE ATTITUDE CONTROL, SPACECRAFT POSITION
INDICATIONS, SOLAR POSITION

(U)

THE SUN SENSOR USED IN THE 3-AXIS CONTROL OF A
SPACECRAFT IS MODELED, AND ITS EFFECTS ON SUN
ACQUISITION PERFORMANCE ARE DEMONSTRATED. THE
SENSOR IS MADE UP OF THE COMBINED OUTPUTS OF FOUR
DISCRETE SOLAR CELLS ELECTRICALLY CONNECTED IN A
MANNER TO ACHIEVE THE CONTROL ERROR SIGNALS. TO
PROTECT THESE CELLS FROM INTERFERING REFLECTIONS FROM
THE SPACECRAFT BODY, A SHADE SURROUNDING EACH CELL IS
ADDED. THE SHADES PRODUCE SIGNIFICANT VARIATIONS
IN SENSOR OUTPUTS FROM THE UNSHADED OUTPUTS.
ACQUISITION CONTROL STABILITY IS INFLUENCED BY THE
INTRODUCTION OF THE SHADE. A SET THEORETIC
APPROACH IS USED TO OBTAIN A MODEL OF THE SHADED
SENSOR OUTPUT. THIS MODEL IS INCORPORATED IN A
RIGID BODY SPACECRAFT SIMULATION, AND SUN ACQUISITION
PERFORMANCE IS PRESENTED.

(U)

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/ZOM07

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-AD04 544 22/2 10/2
AEROSPACE CORP EL SEGUNDO CALIF

SOLAR CELL AND ARRAY STANDARDIZATION FOR
AIR FORCE SPACECRAFT,

(U)

JUL 74 8P KILLIAN, H. J. ; WADE, E. ;
WISE, J. F. ; SAMPSON, H. T. ;
REPT. NO. TR-0075(5901-02)-2
CONTRACT: F04701-74-C-0075
MONITOR: SAMSO TR-74-273

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *SPACECRAFT COMPONENTS,
WEIGHT, STANDARDS, MILITARY REQUIREMENTS,
COSTS
IDENTIFIERS: SOLAR CELL ARRAYS

(U)

(U)

EFFORTS HAVE BEEN IN PROGRESS TO EVALUATE AND TO
ACCOMPLISH SOLAR CELL AND ARRAY STANDARDIZATION FOR
AIR FORCE SPACECRAFT. ANALYSIS RESULTS INDICATE
THAT THE ARRAY AREA AND WEIGHT PENALTIES THAT
TYPICALLY WOULD BE INVOLVED IN THE USE OF A STANDARD
SOLAR CELL MODULE WOULD BE LESS THAN 10%. THE
POTENTIAL PAYOFF OF STANDARDIZATION IS COST SAVINGS
TO THE AIR FORCE AND IMPROVED SOLAR ARRAY
RELIABILITY. COST EXPERIENCE DATA FROM NASA ARE
USED TO SHOW THAT LARGE SAVINGS OVER A 12-YEAR PERIOD
MIGHT BE POSSIBLE. AN ATTEMPT IS BEING MADE TO
STANDARDIZE PROCUREMENT PRACTICES AT THE POWER SYSTEM
AND SOLAR ARRAY LEVELS AND TO STANDARDIZE HARDWARE AT
THE SOLAR CELL LEVEL. THREE DOCUMENTS HAVE BEEN
PREPARED AS PART OF THIS EFFORT: A MILITARY
STANDARD FOR THE DESIGN OF SPACE VEHICLES DC POWER
SYSTEMS (MIL-STD-1539), A MILITARY
SPECIFICATION FOR SOLAR ARRAYS (MIL-S-XXXXX),
AND A MILITARY SPECIFICATION FOR SOLAR CELLS (MIL-
C-83443).

(U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A005 265 10/2 22/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

MATHEMATICAL MODELLING OF THE ROYAL AIRCRAFT
ESTABLISHMENT (RAE) LIGHTWEIGHT FLEXIBLE
SOLAR ARRAY.

(U)

DESCRIPTIVE NOTE: TECHNICAL REPT.,
OCT 74 22P PLIMMER, R. N. A. ;
REPT. NO. RAE-TR-74112
MONITOR: DRIC BR-43578

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, ARRAYS, PANELS,
ATTITUDE (INCLINATION), SPACECRAFT COMPONENTS,
FLEXIBLE STRUCTURES, VIBRATION, MATHEMATICAL
MODELS, SATELLITE ATTITUDE, GREAT BRITAIN
IDENTIFIERS: *SOLAR CELL ARRAYS, SPACECRAFT
CONTROL, CONTROL SIMULATION

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(U)

THE PAPER DESCRIBES THE DEVELOPMENT OF A
MATHEMATICAL MODEL FOR THE ATTITUDE DYNAMICS OF A
SPACECRAFT EQUIPPED WITH A LIGHTWEIGHT FLEXIBLE SOLAR
ARRAY. THE THEORY HAS BEEN DEVELOPED USING A
CONTINUOUS MECHANICS APPROACH AND A COMPUTER PROGRAM
PREPARED TO GENERATE THE LATERAL BENDING MODES OF A
SPACECRAFT COMPRISING A RIGID CENTRAL STRUCTURE
CARRYING A PAIR OF SOLAR ARRAYS SYMMETRICALLY
SITUATED ABOUT THE CENTRAL BODY. FURTHERMORE, THE
PROGRAM WILL GENERATE THE EFFECTIVE INERTIA AND MASS
AS A FUNCTION OF THE FORCING FREQUENCY. THESE ARE
THEN FORMULATED IN THE FORM OF TRANSFER FUNCTIONS
WHICH ARE MORE CONVENIENT FOR CONTROL PROBLEM
ANALYSIS.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A005 918 10/2 20/12
ARMY FOREIGN SCIENCE AND TECHNOLOGY CENTER CHARLOTTESVILLE
VA

LONG WAVE SENSITIVITY OF SOLAR CONVERTERS
N-CDS-CU(2-X)S.

(U)

NOV 74 8P MARCHENKO, A. I. ; PAVELETS,
S. YU. ; FEDORUS, G. A. ;
REPT. NO. FSTC-HT-23-1574-71

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: TRANS. OF UKRAINSKII FIZICHESKII
ZHURNAL (USSR) V15 N9 P1530-1534 1970.

DESCRIPTORS: *SOLAR CELLS, *CADMIUM SULFIDES,
*PHOTOVOLTAIC EFFECT, COPPER COMPOUNDS, SULFIDES,
IMPURITIES, SEMICONDUCTOR JUNCTIONS, INFRARED
SPECTRA, NEAR INFRARED RADIATION, TRANSLATIONS,
USSR

(U)

IDENTIFIERS: *COPPER SULFIDES, PHOTOVOLTAIC
CONVERSION, HETEROJUNCTIONS

(U)

LONG WAVE SENSITIVITY OF SOLAR CONVERTERS N-
CDS-CU(2-X)S--TRANSLATION.

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A009 719 1976
ARMY ELECTRONICS COMMAND FORT MONMOUTH N J

LOW COST INJECTION LASER ENGAGEMENT
SIMULATOR.

(U)

DESCRIPTIVE NOTE: FINAL TECHNICAL REPT.,
APR 75 15P GAMMARINO, R. R. ISCHIEL, E.
J. I
REPT. NO. ECOM-4308
PROJ: DA-1-S-762703-DH-93

UNCLASSIFIED REPORT

DESCRIPTORS: *GUNFIRE, *SIMULATORS, *INJECTION
LASERS, SIMULATION, OPTICAL DETECTORS, TRAINING
DEVICES, SOLAR CELLS
IDENTIFIERS: *HIT INDICATORS

(U)

(U)

A LOW-COST MAN-TO-MAN ENGAGEMENT SIMULATOR IS
DESCRIBED IN THIS REPORT. RIFLE FIRE IS SIMULATED
BY AN INJECTION LASER TRANSMITTER EMITTING 100 NS
PULSES. THE ESSENTIAL COMPONENTS IN THE
TRANSMITTER ARE A TRIPLE GAALAS INJECTION LASER
STACK WITH A 10 W OUTPUT AT 810 NM, AN SCR
DRIVING CIRCUIT, A BATTERY AND A SINGLE LENS (FOCAL
LENGTH = 7.5 CM, F/2) FOR BEAM COLLIMATION TO 2
MRAD. THE IL TRANSMITTER IS MOUNTED ON A M-16
RIFLE AND BORESIGHTED WITH THE RIFLE SIGHT. 'HITS'
ARE DETECTED BY FOUR SOLAR CELLS MOUNTED ON A HELMET,
COVERING A LARGER THAN HEMISPHERICAL FIELD-OF-VIEW. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A010 487 17/9
AEROSPACE CORP EL SEGUNDO CALIF

93 - GHZ RADAR CROSS-SECTION MEASUREMENTS
OF SATELLITE ELEMENTAL SCATTERERS,

(U)

APR 75 37P DYBDAL, ROBERT B. ; KING,
HOWARD E. ;
REPT. NO. TR-0075(5230-40)-4
CONTRACT: F04701-74-C-0075
MONITOR: SAMSO TR-75-127

UNCLASSIFIED REPORT

DESCRIPTORS: •RADAR CROSS SECTIONS, MILLIMETER
WAVES, ARTIFICIAL SATELLITES, SPACECRAFT COMPONENTS,
SOLAR CELLS, THERMAL INSULATION, SATELLITE
ANTENNAS, SCATTERING, EXTREMELY HIGH FREQUENCY (U)

THE RCS OF REPRESENTATIVE SPACECRAFT MATERIALS
AND COMPONENTS WAS MEASURED AT 93 GHZ.
MEASUREMENTS OF SOLAR CELLS, THERMAL BLANKET
MATERIAL, STRUCTURAL COMPONENTS, AND SENSORS ARE
INCLUDED. THESE MEASUREMENTS INDICATE THE HIGHLY
SPECULAR NATURE OF SCATTERING AT MILLIMETER
WAVELENGTHS. THE MEASUREMENTS GENERALLY AGREE WITH
RESULTS PREDICTED ON THE BASIS OF COMMON ASYMPTOTIC
FORMULATIONS. (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-AD11 084 22/2 10/2
ROYAL AIRCRAFT ESTABLISHMENT FARNBOROUGH (ENGLAND)

WORK IN UK ON THE APPLICATIONS OF SOLAR
CELLS IN SPACE;

(U)

DEC 74 16P TREBLE, F. C. ;
REPT. NO. RAE-TR-74159
MONITOR: DRIC BR-44998

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *PHOTOVOLTAIC EFFECT,
SCIENTIFIC SATELLITES, SPACECRAFT COMPONENTS,
SILICON, CADMIUM SULFIDES, REVIEWS, GREAT
BRITAIN

(U)

IDENTIFIERS: ARIEL 3 SATELLITE

(U)

BRITISH EFFORTS AND ACHIEVEMENTS IN THE FIELD OF
PHOTOVOLTAIC SOLAR ENERGY CONVERSION IN SPACE OVER
THE PAST 14 YEARS ARE REVIEWED. THE SATELLITES
POWERED BY BRITISH SOLAR CELLS ARE LISTED AND THE
ARIEL 3 ARRAY IS DESCRIBED IN DETAIL BY WAY OF AN
INTRODUCTION TO THE SUBJECT. SILICON CELLS OF
CONVENTIONAL THICKNESS HAVE BEEN DEVELOPED TO A
CONVERSION EFFICIENCY EXCEEDING 11.5% AND THIN
CELLS WITH A SUPERIOR POWER-TO-WEIGHT RATIO HAVE BEEN
DEVELOPED AND MANUFACTURED IN PILOT PRODUCTION.
OTHER ACHIEVEMENTS ARE A CHEAPER AND BETTER TYPE OF
GLASS COVERSLIP, AN ULTRA-THIN INTEGRAL GLASS COATING
AND LIGHTWEIGHT FLEXIBLE CADMIUM SULFIDE CELLS. IN
ANTICIPATION OF FUTURE MULTIKILOWATT POWER
REQUIREMENTS, A PROTOTYPE LIGHTWEIGHT DEPLOYABLE
ARRAY EMBODYING ADVANCED CONCEPTS HAS BEEN BUILT AND
QUALIFIED FOR PROLONGED OPERATION IN THE
GEOSTATIONARY ORBIT.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A013 921 10/2 22/2
GLOBE-UNION INC EL MONTE CALIF CENTRALAB SEMICONDUCTOR
DIV

HARDENED VIOLET RESPONSE SILICON SOLAR
CELL FOR SATELLITE APPLICATION.

(U)

DESCRIPTIVE NOTE: FINAL REPT. JUN 73-APR 75,
MAY 75 SOP ILES, P. A. :

CONTRACT: F33615-73-C-2073

PROJ: AF-3145

TASK: 314519

MONITOR: AFAPL TR-75-20

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *SILICON, SPACECRAFT
COMPONENTS, RADIATION HARDENING, PERFORMANCE TESTS,
RADIATION EFFECTS, ELECTRICAL RESISTIVITY,
ALUMINUM

(U)

IDENTIFIERS: *SPACECRAFT POWER SUPPLIES

(U)

THIS CONTRACT INVOLVED DEVELOPMENT OF FURTHER
HARDENED VERSIONS OF VIOLET RESPONSE SOLAR CELLS, BY
ADDING ALUMINUM CONTACTS, AND BY TESTING THE EFFECTS
OF HIGHER RESISTIVITY SILICON. THE CONVENTIONAL
VIOLET CELLS IMPROVED STEADILY IN OUTPUT DURING THE
CONTRACT (70-79 MW 2X2 CM) THERE WERE
DIFFICULTIES IN APPLYING SUITABLE FINE LINE ALUMINUM
CONTACTS TO THE SHALLOW DIFFUSED FRONT SURFACE OF THE
CELL. THE BEST VIOLET CELLS WITH ALUMINUM CONTACTS
WERE ABOUT 10% LOWER IN OUTPUT THAN THE USUAL
VIOLET CELLS. RADIATION TESTS SHOWED THAT LOW
RESISTIVITY (1-3 OHM-CM) SILICON STILL GAVE BEST
OVERALL CELL PERFORMANCE. LIMITED ENVIRONMENTAL
TESTS SHOWED THAT THE PERFORMANCE OF VIOLET CELLS WAS
SATISFACTORY. MORE INTENSIVE STUDY OF THE OVERALL
CONTACT PROPERTIES IS SUGGESTED. VIOLET CELLS WITH
BOTH CONVENTIONAL AND ALUMINUM CONTACTS, AND COVERING
A DECADE OF BULK RESISTIVITY VALUES, WERE DELIVERED
FOR EVALUATION, AND FOR ASSOCIATED TESTS.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A015 380 29/12 11/6 11/4 10/2
BROWN UNIV PROVIDENCE R I

ANNUAL TECHNICAL REPORT, MATERIALS RESEARCH
LABORATORY, JULY 1, 1973-JUNE 30, 1974.

(U)

JUN 74 127P

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SPONSORED IN PART BY NATIONAL
SCIENCE FOUNDATION, WASHINGTON, D.C. SEE ALSO
AD-783 648.

DESCRIPTORS: *SCIENTIFIC RESEARCH, *MATERIALS,
PLASTIC DEFORMATION, DISLOCATIONS, LASERS, SOLAR
CELLS, FRACTURE(MECHANICS), STRESS STRAIN
RELATIONS, STRESS CORROSION, CREEP, METALS,
CRACK PROPAGATION, FINITE ELEMENT ANALYSIS,
COMPOSITE MATERIALS, SEMICONDUCTORS, GLASS,
FLUORIDES, NUCLEAR MAGNETIC RESONANCE

(U)

CONTENTS: MICROSCOPIC AND MACROSCOPIC DYNAMIC
PLASTICITY; FRACTURE OF SOLIDS; INORGANIC
GLASSES; CHEMISORPTION ON METALLIC SURFACES;
CHALCOGENIDE MATERIALS; ALLOY DESIGN AND
SYNTHESIS OF MICROSTRUCTURES FOR SPECIFIC PROPERTIES;
PLASMAS IN SOLIDS; LOW TEMPERATURE PROPERTIES OF
MATERIALS; PSEUDO-ONE-DIMENSIONAL CONDUCTORS;
GENERAL STUDIES OF MECHANICAL PROPERTIES;
MATERIALS FOR SOLAR CELLS; OPTICAL PROPERTIES;
MAGNETIC PROPERTIES.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A015 840 10/2 11/2
SIMULATION PHYSICS INC BURLINGTON MASS

STRESS FREE APPLICATION OF GLASS COVERS FOR
RADIATION HARDENED SOLAR CELLS AND
ARRAYS.

(U)

DESCRIPTIVE NOTE: INTERIM REPT. JAN 74-JUN 75,
JUN 75 42P KIRKPATRICK, ALLEN R. ;
MINNUCCI, JOHN A. ;
CONTRACT: F33615-74-C-2001
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-75-54

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *PROTECTIVE COATINGS,
*GLASS, RADIATION EFFECTS, HUMIDITY,
TEMPERATURE, THERMAL CYCLING TESTS, VACUUM
ULTRAVIOLET RADIATION, PROTON BOMBARDMENT, ELECTRON
IRRADIATION, RADIATION HARDENING, BONDING,
SPACECRAFT COMPONENTS

(U)

IDENTIFIERS: *SILICON SOLAR CELLS, BOROSILICATE
GLASS

(U)

THIS REPORT DESCRIBES THE FIRST SIXTEEN MONTHS OF A
TWO AND ONE HALF YEAR PROGRAM TO DEVELOP A PRACTICAL
INTEGRAL PROTECTIVE COVER FOR SILICON SOLAR CELLS.
THE REPORT DISCUSSES SELECTION OF CORNING 7070
BOROSILICATE GLASS AS AN OPTIMUM COVER MATERIAL AND
EXPLAINS THE MECHANICS OF THE ELECTROSTATIC FIELD-
ASSISTED BONDING PROCESS USED FOR COVER APPLICATION.
EXCELLENT RESULTS HAVE BEEN ACHIEVED FOR MOST SOLAR
CELL TYPES. UNDER ENVIRONMENTAL EVALUATIONS AND
ELECTRON AND PROTON IRRADIATION TESTS INTEGRALLY
COVERED CELLS EXHIBIT PERFORMANCE STATISTICALLY AT
LEAST EQUAL TO THAT OF CELLS WITH CONVENTIONAL GLUED
COVERS.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A015 880 10/2 9/1
HUGHES AIRCRAFT CO EL SEGUNDO CALIF SPACE AND
COMMUNICATIONS GROUP

REVERSE CURRENT BLOCKING DIODES FOR
FLEXIBLE SOLAR ARRAY PROTECTION.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 2 APR 73-14 MAR 75,
APR 75 247P LEVY, E. , JR. MCGRATH, R.

J. ;

REPT. NO. SCG-50121R
CONTRACT: F33615-73-C-2060
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-75-23

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR PANELS, *SOLAR CELLS,
*SEMICONDUCTOR DIODES, *PROTECTIVE EQUIPMENT,
FLEXIBLE STRUCTURES, SEMICONDUCTORS, SILICON,
VOLTAGE, DIRECT CURRENT, LEAKAGE(ELECTRICAL),
MIRRORS, IONIZING RADIATION
IDENTIFIERS: *BLOCKING DIODES, REVERSE CURRENT,
MESA STRUCTURES

(U)

(U)

A UNIQUE SOLAR CELL BLOCKING DIODE FOR USE
ON SOLAR PANELS IS DESCRIBED. THE DEVICE HAS THE
PHYSICAL CHARACTERISTICS OF A SOLAR CELL AND THE
ELECTRICAL PROPERTIES OF CONVENTIONAL DIODES
CURRENTLY USED FOR SOLAR ARRAY REVERSE CURRENT
ISOLATION AND PROTECTION. THIS COMBINATION OF
PHYSICAL CHARACTERISTICS AND ELECTRICAL PROPERTIES
PERMITS MOUNTING OF THE DIODE ON THE PANEL SURFACE IN
SERIES WITH SOLAR CELLS, AND IS PARTICULARLY USEFUL
FOR FLEXIBLE ROLLUP SOLAR ARRAYS. THE DIODE
JUNCTION IS DIFFUSED INTO A 1 X 2 CM, 8 MIL THICK,
P-DOPED SILICON BLANK. NOMINAL INVERSE VOLTAGE
STANDOFF CHARACTERISTICS OF 140 VOLTS AT 1 MA
LEAKAGE HAVE BEEN ACHIEVED WITH 20 OHM-CM BASE
RESISTIVITY, 6 MICROMETER DIFFUSED JUNCTIONS, AND
HEAVY SILICON MONOXIDE LAYERS FOR SURFACE
PASSIVATION. TYPICAL FORWARD VOLTAGE DROP AT 0.3/
3.0 AMPERES ARE OF THE ORDER OF 0.8/1.2 VOLTS.
CONVENTIONAL DIODES EXHIBIT NOMINAL INVERSE VOLTAGE
STANDOFF CHARACTERISTICS OF 100 VOLTS AT 25
MICROAMPERES LEAKAGE, AND TYPICAL FORWARD VOLTAGE
DROP OF 0.8/1.0 VOLT AT 0.3/3.0 AMPERES.
(AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A016 529 22/2 10/2 17/7
AEROSPACE CORP EL SEGUNDO CALIF GUIDANCE AND CONTROL
DIV

A GENERAL APPROACH TO THE SHADED SUN
SENSOR MODELING PROBLEM WITH AN APPLICATION
TO THE FLTSATCOM SHADED SUN SENSORS.

(U)

DESCRIPTIVE NOTE: FINAL REPT.,
AUG 75 41P WONG, K. K. ;
REPT. NO. TR-0076(6724-02)-1
CONTRACT: F04701-75-C-0076
MONITOR: SAMSO TR-75-243

UNCLASSIFIED REPORT

DESCRIPTORS: *SATELLITE ATTITUDE, *SOLAR CELLS,
SPACECRAFT COMPONENTS, POSITION FINDING,
MATHEMATICAL MODELS, COMPUTERIZED SIMULATION (U)
IDENTIFIERS: SHADES, SOLAR SENSORS, SPACECRAFT
CONTROL, SATELLITE ATTITUDE CONTROL, SPACECRAFT
POSITION INDICATORS, SOLAR POSITION (U)

SUN SENSORS ARE WIDELY USED IN SPACE VEHICLES FOR
SUN ACQUISITION OR DETERMINATION OF BODY ATTITUDE
RELATIVE TO THE SUN. IN ORDER TO ALLEVIATE
UNDESIRABLE REFLECTIONS FROM THE VARIOUS PARTS OF THE
VEHICLE, SHADES ARE OFTEN INTRODUCED ABOUT THE SUN
SENSITIVE DEVICE. THE ADDED NONLINEARITY IN THE
ATTITUDE CONTROL SYSTEM DUE TO THE EFFECT OF SHADING
ALTERS THE STABILITY MARGIN AND DEGRADES THE
ANALYTICAL RESULTS OBTAINED FROM THE LINEARIZED
APPROACH. A GENERAL APPROACH IS PRESENTED IN THIS
PAPER ON THE MODELING OF SHADED SUN SENSORS. THE
APPROACH APPLIES TO SHADING WALL GEOMETRY AND SOLAR
CELLS WHOSE BOUNDARIES CAN BE DESCRIBED OR
APPROXIMATED BY A PIECEWISE LINEAR RELATION. THE
OUTPUT OF THE CELL, WHICH DEPENDS ON THE SUN ANGLE
AND THE SHADE DIMENSIONS, IS A FUNCTION OF THE
INTERSECTION OF THE SHADE PATTERN WITH THE CELL AREA.
HAVING DEFINED THE SHADE STRUCTURE BY VECTORS FIXED
IN THE SENSOR'S COORDINATE FRAME, THE SHADE
CONTRIBUTION DUE TO EACH PARTITIONED SHADE STRUCTURE
IS CALCULATED SEQUENTIALLY SO THAT IT IS NOT
NECESSARY TO DEFINE AN INTEGRAL SHADE PATTERN AND
VARIOUS BOUNDARY CONDITIONS.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A021 424 10/3 7/5
NAVAL WEAPONS CENTER CHINA LAKE CALIF

EVALUATION OF SOME THIONINE REDOX SYSTEMS
AS POTENTIAL REGENERATIVE PHOTO GALVANIC
BATTERIES,

(U)

FEB 76 25P FINE, DWIGHT A. FLETCHER,
AARON N. ;
REPT. NO. NWC-TP-5813
PROJ: ZR011-07

UNCLASSIFIED REPORT

DESCRIPTORS: *ELECTROCHEMISTRY, *PHOTOELECTRICITY,
*DYES, *SOLAR CELLS, *ETHYLENEDINITRILE
TETRAACETATES, PERFORMANCE TESTS, SULFUR
HETEROCYCLIC COMPOUNDS, NITROGEN HETEROCYCLIC
COMPOUNDS, ENERGY CONVERSION, OXIDATION REDUCTION
REACTIONS, ELECTRODES, COBALT COMPOUNDS,
ELECTROLYTES, PH FACTOR,
CONCENTRATION(CHEMISTRY)
IDENTIFIERS: *PHENAZATHIONIUM/DIAMINO-SULFIDE,
*PHOTO GALVANIC CELLS

(U)

(U)

THIS REPORT SUMMARIZES PRELIMINARY INVESTIGATIONS
ON PHOTOELECTRICAL SYSTEMS INVOLVING THIONINE DYE AND
INORGANIC REDUCING AGENTS; THESE SYSTEMS OFFER
POTENTIAL FOR USE AS PHOTO GALVANIC CELLS IN SOLAR
ENERGY CONVERSION. THE REPORT STRESSES THE
THIONINE-COBALT(II)ETHYLENE-DIAMINETETRAACETATE
(EDTA) SYSTEM, WHICH HAS YIELDED VOLTAGES AND
CURRENTS COMPARABLE TO AND IN SOME CASES EXCEEDING
THOSE WHICH HAVE BEEN REPORTED FOR THE THIONINE-
FE(2+) SYSTEM. MEASUREMENTS ON THE THIONINE-
COEDTA(2-) SYSTEM HAVE BEEN CARRIED OUT USING
TWO TYPES OF TRANSPARENT ELECTRODE, TIN DIOXIDE AND
GOLD/PALLADIUM. EFFECTS OF CONCENTRATION AND AGING
ON VOLTAGES ARE REPORTED HERE, AS WELL AS RESULTS OF
CLOSED-CIRCUIT MEASUREMENTS UNDER LOAD.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A022 052 10/2
JOHNS HOPKINS UNIV LAUREL MD APPLIED PHYSICS LAB

SPUTTER ION MASS SPECTROMETER ANALYSIS OF
COPPER SULFIDE/CADMIUM SULFIDE SOLAR CELL
SAMPLES.

(U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
OCT 75 55P SATKIEWICZ, F. G. ; CHARLES,
H. K. ; JR;
REPT. NO. APL/JHU-TG-1284
CONTRACT: N00017-72-C-4401

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *PHOTOVOLTAIC EFFECT,
COPPER COMPOUNDS, CADMIUM SULFIDES, PERFORMANCE
TESTS, MASS SPECTROMETRY, ATOMIC SPECTRA, CHEMICAL
ANALYSIS, IONS, HETEROJUNCTIONS, SPUTTERING
IDENTIFIERS: *CADMIUM SULFIDE SOLAR CELLS,
*SPUTTER ION SOURCE MASS SPECTROMETRY, DESIGN
CRITERIA, SIMS TECHNIQUE

(U)

(U)

THE CAPABILITIES OF THE APPLIED PHYSICS
LABORATORY INCLUDE SOLAR SIMULATORS AND CONTROL
CELL STANDARDS FOR PROPER TESTING AND EVALUATION OF
SOLAR CELL PERFORMANCE, CONTROLLED TEMPERATURE AND
ATMOSPHERE FURNACES TO STUDY THE EFFECTS OF AMBIENT
GASES (SURFACE EFFECTS) AND IMPURITY DIFFUSION
(JUNCTION EFFECTS), AND A SPUTTER ION SOURCE MASS
SPECTROMETER (SIMS) THAT CAN PROVIDE BOTH IONIC AND
POLYATOMIC SPECIES VERSUS DEPTH PROFILES FOR THE
CU₂S/CDS SAMPLES. ANALYSIS OF SURFACE
SPECIES BEFORE AND AFTER AMBIENT EXPOSURE MAY LEAD TO
THE DEVELOPMENT OF EFFECTIVE SURFACE COATINGS.
PROFILE DATA THROUGH THE JUNCTION REGION MAY AID IN
THE STUDY OF IMPURITY DIFFUSION, WHICH IS BELIEVED TO
BE A CHIEF SOURCE OF TEMPERATURE DEGRADATION IN THE
CU₂S/CDS SYSTEM. AN EXPLORATORY STUDY WAS
CONDUCTED TO DETERMINE THE FEASIBILITY OF THE SIMS
TECHNIQUE. THIS REPORT SUMMARIZES ITS
RESULTS.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-AL22 713 10/2 12/1 9/2
JOHNS HOPKINS UNIV LAUREL MD APPLIED PHYSICS LAB

SAS-C SOLAR ARRAY DEPLOYMENT
DYNAMICS.

(U)

DESCRIPTIVE NOTE: TECHNICAL MEMO.,
AUG 75 67P WILLIAMS, C. E. ;
REPT. NO. APL/JHU/TG-1281
CONTRACT: N00017-72-C-4401

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR PANELS, *EQUATIONS OF MOTION,
*COMPUTERIZED SIMULATION, NONLINEAR SYSTEMS,
DIGITAL COMPUTERS, DEPLOYMENT, CONFIGURATIONS,
PLANAR STRUCTURE, VACUUM CHAMBERS, EXPERIMENTAL
DATA, SPACECRAFT, SPINNING(MOTION), DIGITAL
SIMULATION

(U)

IDENTIFIERS: *SOLAR ARRAYS, UNFOLDING ARRAY,
DEPLOYMENT DYNAMICS, SPACECRAFT DESPIN, DESPIN

(U)

SAS-C HAS FOUR SEGMENTED SOLAR ARRAYS, EACH
CONSISTING OF THREE CONTIGUOUS, SPRING-CONNECTED
SOLAR PANELS. ARRAY DEPLOYMENT INVOLVES UNFOLDING
FROM AN INVERTED 'N' CONFIGURATION TO AN EXTENDED
PLANAR CONFIGURATION. THE DEPLOYMENT DYNAMICS OF
THIS TYPE OF MECHANICAL SYSTEM ARE SUCH THAT THE
POSSIBILITY OF DAMAGE TO ANY ONE OF THE FOUR SOLAR
ARRAYS, BECAUSE OF UNDESIRABLE DEPLOYMENT DYNAMICS,
IS QUITE SIGNIFICANT. MINIMIZING THIS POSSIBILITY
HAS BEEN THE OBJECTIVE OF AN ANALYTICAL AND
EXPERIMENTAL INVESTIGATION. IN THE ANALYTICAL
INVESTIGATION, DIGITAL COMPUTER SIMULATIONS WERE USED
TO EXAMINE MANY ASPECTS OF THE DEPLOYMENT DYNAMICS.
THE SIMULATIONS RESULTED IN A SET OF ARRAY SPRING
AND MASS PARAMETERS THAT MINIMIZE DEPLOYMENT DAMAGE
POTENTIAL. EXPERIMENTAL INVESTIGATIONS CONSISTED OF
SPACECRAFT DESPIN AN ARRAY DEPLOYMENT IN A VACUUM
CHAMBER. THE REPORT PRESENTS ANALYTIC AND
EXPERIMENTAL RESULTS. ACCEPTABLE AGREEMENT WAS
OBTAINED BETWEEN THE VACUUM TEST DATA AND THE DIGITAL
SIMULATION. ALL OF THE RESULTS INDICATE THAT THE
EXPECTED DEPLOYMENT DYNAMICS ARE ACCEPTABLE FOR
FLIGHT.

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UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A025 719 10/2 22/2
TEXAS INSTRUMENTS INC DALLAS SEMICONDUCTOR GROUP

DEVELOPMENT OF VERTICAL MULTIJUNCTION SOLAR
CELLS FOR SPACECRAFT PRIMARY POWER. VOLUME
II. (U)

DESCRIPTIVE NOTE: FINAL REPT. JUN 74-JUN 75,
NOV 75 54P LLOYD, W. W. ; YEAKLEY,
RICHARD ; FULLER, CLYDE ; MALONE, FARRIS ;
REPT. NO. TI-03-75-41
CONTRACT: F33615-73-C-2019
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-74-45-VOL-2

UNCLASSIFIED REPORT

SUPPLEMENTARY NOTE: SEE ALSO REPORT DATED JUN 74, AD-
A001 084.

DESCRIPTORS: *SOLAR CELLS, SPACECRAFT, POWER
SUPPLIES, SPACEBORNE, RADIATION HARDENING, LONG
WAVELENGTHS, RESPONSE (U)
IDENTIFIERS: *VERTICAL MULTIJUNCTION SOLAR CELLS,
SOLAR ARRAYS (U)

BASED ON THE TYPES OF VERTICAL MULTIJUNCTION CELLS
DEVELOPED IN THE FIRST HALF OF THIS CONTRACT
(REPORT NO. AFAPL-TR-74-45), THE OPEN-
GROOVE TYPE CONFIGURATION WAS SELECTED SINCE EARLY
CHARACTERIZATION RESULTS SHOWED THE PREDICTED
IMPROVEMENTS IN LONG-WAVE RESPONSE AND TOLERANCE TO
ELECTRON BOMBARDMENT. IN ADDITION, A PROCESS WAS
DEVELOPED THAT CONVERTS THE SURFACE OF THIS CELL INTO
AN EFFECTIVE BLACK BODY, WHICH ALSO HAS THE POTENTIAL
OF REDUCING THE AREA OF THE COLLECTING JUNCTION.
CELLS MADE USING THE BLACK-SURFACE, OPEN-GROOVE
STRUCTURE HAVE DEMONSTRATED THAT THE SHORT CIRCUIT
CURRENT HAS DROPPED ONLY 13% AFTER EXPOSURE TO 10
TO THE 16TH POWER, MEV ELECTRONS; THE BLUE
RESPONSE IS NOT LIMITED BY THE DEEP GROOVES; THE
LONG-WAVE RESPONSE CAN BE 30% HIGHER THAN FOR A
CONVENTIONAL CELL; ACTUAL EFFICIENCIES OF 9% HAVE
BEEN OBTAINED, WITH A CLEAR POTENTIAL OF REACHING
14%. TOGETHER WITH THE SIGNIFICANTLY SIMPLIFIED
PROCESSES DEVELOPED FOR THE FABRICATION OF THE CELLS,
THESE RESULTS SHOW THAT THE VERTICAL
MULTIJUNCTION CELL IS A VIABLE DEVICE FOR
SPACECRAFT POWER. (AUTHOR) (U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A025 922 10/3
SPECTROLAB INC SYLMAR CALIF

LOW REFLECTIVITY SOLAR CELLS.

(U)

DESCRIPTIVE NOTE: FINAL REPT. 31 MAY 74-4 JAN 76,
JAN 76 83P STELLA, PAUL ; AVERY, JAMES ;
SCOTT-MONCK, JOHN ;
REPT. NO. 380-4686F
CONTRACT: F33615-74-C-2044
PROJ: AF-3145
TASK: 314519
MONITOR: AFAPL TR-75-98

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *ANTIREFLECTION COATINGS,
REFLECTIVITY, REFLECTION, REFLECTANCE, ETCHING,
SILICON, QUARTZ, SODIUM, POTASSIUM COMPOUNDS,
HYDROXIDES

(U)

IDENTIFIERS: *SILICON SOLAR CELLS, SOLAR ENERGY
CONVERSION, PHOTOVOLTAIC CONVERSION

(U)

TECHNIQUES FOR BOTH REDUCING AND CHANGING SPECULAR
REFLECTANCE FROM SILICON SOLAR CELL ASSEMBLIES
(CELL AND COVER) WERE DEVELOPED. MECHANICAL
AND CHEMICAL TREATMENTS OF QUARTZ CELL COVERS YIELDED
SURFACES THAT ACTED LIKE NEARLY PERFECT DIFFUSERS OF
INCOMING VISIBLE RADIATION. A FOUR ORDER OF
MAGNITUDE REDUCTION IN SPECULAR REFLECTIVITY WAS
ACHIEVED IN THIS MANNER. SELECTIVE ETCHES AND
MULTIPLE ANTIREFLECTION (AR) COATINGS WERE USED TO
REDUCE THE TOTAL REFLECTION FROM THE CELL. ETCHES
SUCH AS SODIUM AND POTASSIUM HYDROXIDE REDUCED THE
TOTAL REFLECTION OVER THE ENTIRE SILICON CELL
SPECTRUM (350-1100 NM) TO BELOW ONE PERCENT, WITH
A CORRESPONDING INCREASE IN OUTPUT CURRENT OF NEARLY
EIGHT PERCENT OVER CONVENTIONALLY PREPARED SURFACES.
SOME DEGRADATION IN FILL FACTOR WAS OBSERVED WITH
THE ETCHED SURFACE SO THAT THE CURRENT INCREASE AT
THE LOAD VOLTAGE WAS SOMEWHAT LESS THAN AT SHORT
CIRCUIT.

(U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A025 923 10/3
AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB
OHIO

SOLAR CELL OBSERVABLES REDUCTION
TECHNIQUES.

(U)

DESCRIPTIVE NOTE: FINAL REPT. SEP 74-OCT 75,
APR 76 45P GEIS, JACK W. ;
REPT. NO. AFAPL-TR-76-13
PROJ: AF-3145
TASK: 314519

UNCLASSIFIED REPORT

DESCRIPTORS: •SOLAR CELLS, ANTIREFLECTION COATINGS,
REFLECTANCE, OPTICAL PROPERTIES, ELECTRICAL
PROPERTIES, REFLECTION

(U)

AN IN-HOUSE STUDY OF THE OPTICAL AND ELECTRICAL
PROPERTIES OF SOLAR CELLS HAS REVEALED THAT IT IS
POSSIBLE TO REDUCE THE SPECULAR COMPONENT OF
REFLECTED LIGHT INTENSITY BY ABOUT THREE TO FOUR
ORDERS OF MAGNITUDE THROUGH PROPER TREATMENT OF THE
CELL SURFACE, ELECTRICAL CONTACTS, AND THE
COVERGLASS. THE STUDY REVEALED THAT CELL
COVERGLASSES MECHANICALLY AND CHEMICALLY TREATED TO
PRODUCE A ROUGHENED SURFACE WILL MULTIPLY REFLECT AND
DISPERSE INCIDENT LIGHT CAUSING A SIGNIFICANT
REDUCTION IN REFLECTED LIGHT INTENSITY.

(U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A025 978 17/2.1 10/2
YUMA PROVING GROUND ARIZ

REMOTE PORTABLE SOLAR POWERED MICROWAVE
SYSTEM,

(U)

76 10P BOTTONE, ANTHONY G. :

UNCLASSIFIED REPORT

DESCRIPTORS: *DATA LINKS, *RADIO LINKS, *REMOTE
TERMINALS, *SOLAR CELLS, PHOTOVOLTAIC EFFECT,
DISCONE ANTENNAS, TELEVISION TRANSMITTERS, DATA
RATE, RANGE(DISTANCE), VIDEO SIGNALS, VOICE
COMMUNICATIONS, TELEMETERING DATA, RADIO
TRANSMITTERS, TEST METHODS

(U)

DURING THE PROCESS OF TESTING, DEVELOPMENT, AND
EVALUATION OF ARMY MATERIAL, DATA IS OFTEN REQUIRED
OR DESIRED TO BE TRANSMITTED FROM REMOTE, ISOLATED OR
RUGGED LOCATIONS. PRESENT DAY METHODOLOGY
REGARDING COMMUNICATIONS SUPPORT OF THESE REMOTE
TESTS AND EVALUATION IS LIMITED IN FLEXIBILITY,
MOBILITY, BANDWIDTH, AND APPLICATION. IN ADDITION,
THIS PRESENT DAY METHODOLOGY INVOLVES RELIANCE ON
FIRM-FIXED OR GENERATOR POWER AND PRESENTS A DRAWBACK
OF NOT BEING ABLE TO OPERATE IN REAL-TIME MODES THAT
ARE ESSENTIAL IN SUPPORT OF SOME MISSIONS OF THE
DEPARTMENT OF THE ARMY. TO SOLVE THE PROBLEMS
MENTIONED ABOVE, A COMPARATIVELY INEXPENSIVE, HIGHLY
RELIABLE, SELF CONTAINED AND SIMPLE SOLUTION HAS BEEN
DEvised AND SUCCESSFULLY TESTED. A HIGHLY EFFICIENT
MICROWAVE TRANSMITTER THAT OPERATES FROM LOW VOLTAGE
D.C. POWER HAS BEEN COUPLED WITH A PHOTOVOLTAIC
SOLAR ACTIVATED POWER SOURCE (ARRAY OF SOLAR
CELLS). THIS COMBINATION, USING A MINIATURE 8 OZ.
OMNIDIRECTIONAL DISCONE ANTENNA, TRANSMITTED A 525
LINE TELEVISION PRESENTATION OF A MISSION TEST IN
REAL TIME, OVER A DISTANCE OF SEVERAL MILES. THE
PORTABLE SOLAR POWERED TERMINAL TOOK APPROXIMATELY 15
MINUTES SET UP TIME, AND OPERATED SUCCESSFULLY FOR
THE DURATION OF THE TEST.

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A030 529 10/1
NAVAL RESEARCH LAB WASHINGTON D C

NAVY APPLICATIONS FOR TERRESTRIAL
PHOTOVOLTAIC SOLAR POWER.

(U)

DESCRIPTIVE NOTE: INTERIM REPT.,
SEP 76 39P STATLER, R. L. ;HUBLER, G.
K. ;GUENZER, C. S. ;FARADAY, B. J. ;
REPT. NO. NRL-MR-3363
PROJ: NRL-H01-55, RR012-06
TASK: RR012-06-41

UNCLASSIFIED REPORT

DESCRIPTORS: *ENERGY CONVERSION, *PHOTOVOLTAIC
EFFECT, *SOLAR ENERGY, *SOLAR CELLS, SOLAR
RADIATION, ELECTRIC POWER, COST EFFECTIVENESS,
NAVIGATIONAL AIDS, COMMUNICATION EQUIPMENT,
SURVEILLANCE

(U)

THE U.S. ARMY MOBILITY EQUIPMENT
RESEARCH AND DEVELOPMENT CENTER (MERDC),
FORT BELVOIR HAS BEEN TASKED BY THE ASSISTANT
SECRETARY OF DEFENSE (INSTALLATIONS AND
LOGISTICS) WITH ENERGY RESEARCH AND
DEVELOPMENT ADMINISTRATION (ERDA) FUNDS TO
PREPARE A DEPARTMENT OF DEFENSE PROPOSAL FOR
INSTALLING TERRESTRIAL SOLAR PHOTOVOLTAIC POWER IN
DOD OPERATIONAL SYSTEMS. THIS REPORT DESCRIBES
A SURVEY MADE BY THE RADIATION EFFECTS BRANCH
OF THE RADIATION TECHNOLOGY DIVISION TO
IDENTIFY SPECIFIC TERRESTRIAL SOLAR PHOTOVOLTAIC
POWER APPLICATIONS APPROPRIATE TO DOD OPERATIONAL
SYSTEMS AND FACILITIES.

(U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A030 532 10/2 22/2 20/6
AEROSPACE CORP EL SEGUNDO CALIF CHEMISTRY AND PHYSICS
LAB

COMSAT NONREFLECTIVE SOLAR CELL
EVALUATION.

(U)

DESCRIPTIVE NOTE: INTERIM REPT.,
AUG 76 16P JOSLIN, DAVID E. ;
REPT. NO. TR-0076(6111)-7
CONTRACT: F04701-75-C-0076
MONITOR: SAMSO TR-76-189

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *COMMUNICATION
SATELLITES, *RADIATION HARDENING, ANTIREFLECTION
COATINGS, EFFICIENCY, SILICON, COLORS,
ELECTRICAL RESISTANCE, SHORT CIRCUITS

(U)

IDENTIFIERS: NONREFLECTIVE CELLS, SPECTRAL
RESPONSE, CAPTURE EFFICIENCY, VIOLET,
INTERFERENCE FILTERS

(U)

THE NEW COMSAT NONREFLECTIVE CELL IS REPORTED
TO HAVE A GREATER AIRMASS-ZERO EFFICIENCY THAN THE
COMSAT VIOLET CELL. THE RESULTS OF AN
EVALUATION OF SPECTRAL RESPONSE AND DIODE
CHARACTERISTICS OF THE NEW SOLAR CELL ARE DESCRIBED
IN THIS REPORT. (AUTHOR)

(U)

UNCLASSIFIED

DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A031 893 10/3 20/5
NAVAL POSTGRADUATE SCHOOL MONTEREY CALIF

EXAMINATION OF LASER-PRODUCED PRESSURE
PULSES IN A GALLIUM ARSENIDE SOLAR
CELL.

(U)

DESCRIPTIVE NOTE: MASTER'S THESIS,
JUN 76 124P JACOBSON, JOHN FRANK :

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR CELLS, *PRESSURE MEASUREMENT,
INFRARED PULSES, GALLIUM ARSENIDES, PRESSURE
GAGES, CARBON DIOXIDE LASERS, TEA LASERS,
IRRADIATION, QUARTZ, GOLD, ABSORPTION, THESES,
GERMANIUM, THERMOPILES
IDENTIFIERS: *LASER IRRADIATION

(U)

(U)

PRESSURE PULSES CAUSED BY IRRADIATION OF A MODEL
GALLIUM ARSENIDE SOLAR CELL WITH A CARBON DIOXIDE
TEA LASER WERE EXAMINED USING POWER DENSITIES OF
THE ORDER OF 10 TO THE 7TH POWER WATTS/SQ CM. THE
PRESSURE PULSES WERE MONITORED WITH A SANDIA TYPE
QUARTZ PRESSURE GAUGE. IT WAS DISCOVERED THAT THE
RELATIVELY LOW POWER DENSITIES USED WERE CAPABLE OF
REMOVING THE SILICON DIOXIDE ANTIREFLECTIVE AND GOLD
CONTACT LAYERS OF THE SOLAR CELL AFTER ONLY A FEW
SHOTS OF THE LASER. AN EXPONENTIAL RELATIONSHIP
BETWEEN THE INITIAL THICKNESSES OF THESE LAYERS AND
THE PRESSURE PULSE GENERATED IN THE GALLIUM ARSENIDE
SUBSTRATE WAS INDICATED FOR GOLD CONTACT LAYERS OF
LESS THAN 5000 A THICKNESS. EVIDENCE WAS FOUND
THAT THE PRINCIPAL PRESSURE GENERATION MECHANISM IS
THERMO-MECHANICAL. GOLD FILMS OF THICKNESS GREATER
THAN 5000 A WERE FOUND TO BE ABLE TO ABSORB THE
POWER DENSITIES USED WITH NO APPARENT DAMAGE.
(AUTHOR)

(U)

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DDC REPORT BIBLIOGRAPHY SEARCH CONTROL NO. /ZOM07

AD-A034 987 10/2 17/7
COAST GUARD RESEARCH AND DEVELOPMENT CENTER GROTON
CONN

LABORATORY EVALUATION OF SOLAR POWER UNITS
FOR MARINE AIDS TO NAVIGATION.

(U)

DESCRIPTIVE NOTE: INTERIM REPT.,
JUN 76 79P RYBA, JOHN S. ; NAUS, DAVID

A. 1
REPT. NO. CGR/DC-5/76
MONITOR: USCG D-106-76

UNCLASSIFIED REPORT

DESCRIPTORS: *SOLAR ENERGY; *POWER SUPPLIES,
*NAVIGATIONAL AIDS, *SOLAR PANELS, *SOLAR CELLS,
ELECTRIC BATTERIES, PERFORMANCE(ENGINEERING),
COAST GUARD, MARKER LIGHTS, VOLTAGE REGULATORS,
QUALITY CONTROL, TEMPERATURE, LABORATORY TESTS,
PHOTOVOLTAIC EFFECT
IDENTIFIERS: SOLAR ARRAYS, SPECTROLAB ARRAYS

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THIS REPORT DESCRIBES THE COAST GUARD
EVALUATION OF SOLAR ENERGY AS A POWER SOURCE FOR
LIGHTED AIDS TO NAVIGATION. FIFTY-THREE SOLAR
POWERED AIDS, ON TEST IN A NATURAL ENVIRONMENT AT
GROTON, CONNECTICUT, HAVE BEEN CONTINUOUSLY
MONITORED FOR TWO YEARS. SOLAR ARRAYS FROM TWO
MANUFACTURERS WERE TESTED WITH NEITHER BEING WHOLLY
SATISFACTORY. ONE HAD MAJOR QUALITY CONTROL
PROBLEMS WHILE THE OTHER SUFFERED FROM INADEQUATE
SEALING. THREE TYPES OF LEAD-ACID BATTERIES USED
FOR ENERGY STORAGE HAVE ALL BEEN SATISFACTORY TO
DATE. THE TEST HAS INDICATED THE ADVANTAGES OF
VOLTAGE REGULATION IN REDUCING WATER USE IN
BATTERIES, BUT HAS NOT PROVED THAT REGULATION IS IN
FACT REQUIRED FOR LONG BATTERY LIFE. THE
INSOLATION MEASURED HAS SHOWN EXCELLENT AGREEMENT
WITH THAT PREDICTED USING THE AVERAGES FROM A
SURROGATE AREA. ALMOST ALL OF THE ORIGINAL
ESTIMATES THAT WERE MADE TO PREDICT SYSTEM
PERFORMANCE (BATTERY CAPACITY VS. TIME OF YEAR)
PROVED TO BE VERY CONSERVATIVE AND MOST OF THE
SYSTEMS PERFORMED BETTER THAN EXPECTED.
(AUTHOR)

(U)

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CORPORATE AUTHOR - MONITORING AGENCY

*ADVANCED RESEARCH PROJECTS AGENCY
ARLINGTON VA

ARPA-80 59
HIGH EFFICIENCY SILICON SOLAR
CELLS

AD- 257 434

ARPA-80 59
INVESTIGATION OF OPTICAL
COATINGS FOR SOLAR CELLS

AD- 271 599

ARPA-80 61
INVESTIGATION OF SINGLE ENERGY
GAP SOLAR CELL MATERIAL

AD- 263 861

*AERONAUTICAL SYSTEMS DIV WRIGHT-
PATTERSON AFB OHIO

ASD-TDR-62-69
RESEARCH ON SOLAR-ENERGY
CONVERSION EMPLOYING CADMIUM
SULFIDE

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ASD-TDR-62 882
SOLAR ENERGY MEASUREMENT
TECHNIQUES

AD- 400 559

ASD-TDR-63 516
APPLIED RESEARCH PROGRAM ON
HIGH TEMPERATURE RADIATION
RESISTANT SOLAR CELL ARRAY, VOLUME
I.

AD- 411 257

ASD-TDR-63 516
APPLIED RESEARCH PROGRAM ON
HIGH TEMPERATURE RADIATION
RESISTANT SOLAR CELL ARRAY, VOLUME
II.

AD- 428 634

ASD-TDR-63 743
INVESTIGATION OF THIN FILM
CADMIUM SULFIDE SOLAR CELLS.

AD- 423 684

ASD-TN-61 156
DESIGN STUDY OF SOLAR ENERGY
MEASUREMENT TECHNIQUES.

AD- 281 829

ASD-TN-61 11
SOLAR CELL ARRAY OPTIMIZATION

AD- 270 131

ASD-TN-61 11 V2
SOLAR CELL ARRAY OPTIMIZATION,
VOLUME II

AD- 274 841

*AEROSPACE CORP EL SEGUNDO CALIF
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93 - GHZ RADAR CROSS-SECTION
MEASUREMENTS OF SATELLITE ELEMENTAL
SCATTERERS.

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SPACECRAFT.

(SAMSO-TR-74-273)

AD-A004 544

*AEROSPACE CORP EL SEGUNDO CALIF
LABS DIV

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(SSD-TR-67-89)

AD- 654 285

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CONSAY NONREFLECTIVE SOLAR CELL
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AD-A030 532

*AEROSPACE CORP EL SEGUNDO CALIF
ENGINEERING SCIENCE OPERATIONS

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SPACECRAFT ACQUISITION PERFORMANCE
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WITH AN APPLICATION TO THE
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AD-A016 529

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AD- 676 976

*AEROSPACE RESEARCH LABS WRIGHT-
PATTERSON AFB OHIO

ARL-60
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SOLAR ENERGY INTO POWER SOURCES

AD- 269 508

ARL-67-0190
RESEARCH ON THE MECHANISM OF
THE PHOTOVOLTAIC EFFECT IN HIGH-
EFFICIENCY CDS THIN-FILM SOLAR
CELLS.

AD- 661 557

ARL-67-0282
FABRICATION OF CADMIUM SULFIDE
THIN FILM SOLAR CELLS FOR SPACE

AIR-AIR

UNCLASSIFIED

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AD- 666 439

ARL-68-0217

IMPROVEMENTS IN CDS THIN FILM SOLAR CELLS.

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AD- 702 095

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AD- 710 636

ARL-70-0169

RESEARCH ON THE OPERATING AND FAILURE MECHANISMS IN CDS SOLAR CELLS.

AD- 722 112

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AIR FORCE AERO PROPULSION LAB WRIGHT-PATTERSON AFB OHIO

AD- 434 706

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RESEARCH ON THIN FILM POLYCRYSTALLINE SOLAR CELLS.

AD- 611 535

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AD- 807 711

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THIN SILICON SOLAR CELLS BY ION IMPLANTATION.

AD- 817 614

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AD- 819 491

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AD- 836 663

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AD- 852 760

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AD- 867 832

AFAPL-TR-70-24

SOLAR CELL NEUTRON DAMAGE INVESTIGATION.

AD- 869 460

AFAPL-TR-70-30

SILICON CELL LIFETIME AND EFFICIENCY IMPROVEMENT.

AD- 875 751

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AFAPL-TR-72-69-VOL-3

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AD- 754 901

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LITHIUM-DOPED SILICON SOLAR
CELLS STATE-OF-THE-ART.
AD- 764 357

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CELL CONTRACTS.
AD- 764 816

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LONG LIFE HARDENED LITHIUM
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NEUTRON IRRADIATION TEST OF
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SPACECRAFT PRIMARY POWER. VOLUME

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HARDENED VIOLET RESPONSE
SILICON SOLAR CELL FOR SATELLITE
APPLICATION.
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REVERSE CURRENT BLOCKING DIODES
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HANSCOM AFB MASS

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AD- 710 081

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DATA.
AD- 772 817

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AIR FORCE CAMBRIDGE RESEARCH LABS L 6
HANSCOM FIELD MASS

AFAPL-TR-72-0045
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NEAR THE INTERFACE OF DIFFERENT
ATOMIC NUMBER MATERIALS.
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AFAPL-TR-72-0045
SOLAR CELL RADIATION RESPONSE
NEAR THE INTERFACE OF DIFFERENT
ATOMIC NUMBER MATERIALS.
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AIR FORCE MATERIALS LAB WRIGHT-
PATTERSON AFB OHIO

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MANUFACTURING METHODS FOR
SILICON DENDRITE SOLAR CELLS.
AD- 477 447

AIR FORCE ROCKET PROPULSION LAB
EDWARDS AFB CALIF

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